COAL AGE

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THIS is no fable designed to convey a moral; nor is it fiction built from imagination; it is a brief recital of experience common to many coal men.

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One evening, several years ago, I was sitting in my office poring over a map and figuring some way around a fault that had cut off our best coal. Of a sudden, the mine on the hill, 1000 ft. above, exploded. I jumped to the door; the mouth of the main entry was belching fire; the valley lighted up as though it was day, and the air filled with timbers, cars and coal.

Only the night shift was underground, but at such a time we don't figure whether half-a-dozen or half-a-thousand lives are at stake.

Soon the fan was running, a rescue party formed and messages despatched for help and material.

The mine was an open-light operation; in fact only a few safety lamps were available in the camp. Rescue apparatus had not been introduced in America, and the first-aid movement was only in its inception, so that no trained corps were available.

Men never worked harder than the fearless fellows on that rescue party. Each individual was striving in a common cause—the saving of human life. There was no thought of recompense, and less of personal danger. Even wives and children were momentarily forgotten.

For six hours the party worked with frantic haste, realizing each moment was precious. Ears were strained for the slightest sound of life on ahead. Brattice after brattice was built, and the air was pulling strong up to the point the rescuers had reached. When—

Without warning, there was a second explosion, and of all the volunteers who went underground that night only three live to tell.

Since then, I have been present at a number of mine disasters and have looked on the bodies of many victims, but the faces of the men who served on this, my first rescue party, are ever vivid in memory.

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Regret is futile, and mistakes are but lessons in wisdom. The past cannot be changed; only the future is in our control. Still I often think how differently I would act now, and how unnecessary was the sacrifice of all those lives.

There would be no open lights in that party, no matter how strong the air-current, if the chance to serve came again tonight. Pell-mell haste would be forbidden, and I would fell or shoot the first man to disobey an order or venture ahead on his own responsibility—better one man die than a dozen.

It would be easy to fill a page telling what course I would now pursue; however, this is to be a reminder rather than a sermon.

You know that most of our misfortunes in the mines result from a disregard of common knowledge, a violation of elementary principles, or, last and greatest, a hasty and mistaken show of bravery.

We are fully aware of the dangers to be encountered, and many understand the technology of gas and dust explosions. What we lack most is courage—not courage to go underground and face the dangers, but a more heroic type that refuses exposure to needless danger.

Courage without wisdom is mere boldness, and this sort defeats itself. Be sure of the men you are with; your party as a whole is only as safe as the most ignorant and most careless member. *In many instances, more men have perished in the attempted rescue than were killed in the initial explosion.*

Work and Purposes of Mining Bureau

The Federal Bureau of Mines, with Joseph A. Holmes as its director, on July 1, rounded out the first fiscal year of its existence. It has been a year fraught with effective organization, and big accomplishments. It may seem hardly fair to say the latter, for it must be remembered that the Bureau of Mines is the successor to the Technologic branch of the United States Geological Survey, and that its work was but a continuation and enlargement of the problems outlined several years ago by Doctor Holmes as head of this branch. The real work of the Bureau of Mines has therefore been going on since 1907 which will be remembered as the darkest year in the history of American coal mining, the aggregate number of deaths in accidents reaching a higher total than ever before.

The Bureau of Mines has made many important original investigations. Not less important has been its educative work, resulting in many economic and safety developments. It has been of much practical assistance in mine explosions.

Loss of Life in the Coal Mines

The most important problem before the Bureau of Mines is an attempt to reduce the number of deaths in the mines and it is gratifying to note that in the last three years for which statistics are obtainable, there has been a decrease in the number of fatalities amounting to 25 per cent. In the year 1907, three thousand one hundred and twenty-five miners lost their lives, or 4.86 in every 1000 employed. In 1909, the last year for which there are official statistics, the number of deaths was 2412 or 3.62 men in every 1000 employed.

The record of the three years is as follows:

Year	Killed	Injured	Death Rate per 1,000 Employed
1907	3,127	5,316	4.86
1908	2,451	6,772	3.60
1909	2,412	7,979	3.62

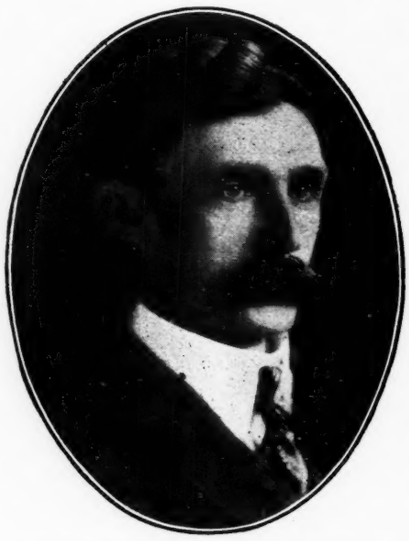
As the year 1907 was the greatest in the history of American coal mining in the amount of tonnage and the number of men employed, it has been argued that the reduction in the number of deaths in the ensuing years may not be taken as an accurate criterion of improvement in conditi[illegible] However, the number of tons of coal mined for each life lost in the three years shows conclusively the betterment of conditions. The statistics are as follows:

1907	145,471 tons
1908	167,545 tons
1909	186,567 tons

Still another way of showing the improvement is by the number of lives lost for each million tons of coal mined during 1907, 1908 and 1909:

1907	6.80
1908	5.96
1909	5.36

The Bureau of Mines does not pretend to take all the credit for this reduction in the number of deaths in the mines. The agitation which followed the four explosions in December, 1907, in which more than 700 men were killed, undoubtedly brought forth a new sense of responsibility upon the part of both the operator and the miner. This led to a more serious realization of the dangers that lurk underground and a desire to find the remedy.



J. A. Holmes, Director of Bureau of Mines

Explosibility of Coal Dust

The Bureau of Mines has performed no service better for the country than drawing attention to the fact, little credited at that time, that coal dust in a bituminous mine is more dangerous and more deadly to the miner than gas. Heretofore it had been believed that firedamp was the greatest menace of the mines and but little effort was made to prevent the accumulation of coal dust. Although many miners and mine operators believed the dust of bituminous coal would ignite from an explosion of firedamp, nearly all of them contended that the dust in a mine free from gas would not explode. Consequently in many mines where no firedamp would ordinarily be detected, miners paid little attention to coal dust, and in some of these mines terrible explosions have taken place.

The comfirmatory demonstration to the American public by the Bureau of Mines that coal dust was the greatest menace to the mines called attention to another important phase of the problem, known indeed before, but none too generally. The most serious disasters had occurred more frequently in bituminous mines in the late fall and winter than during late spring and summer. The experts directed attention to the fact that the mines were drier in the winter than in the summer and therefore the coal dust was more liable to explode. They explained that cold air holds less moisture than warm air. The cold air, entering the mine to ventilate it, takes up the natural warmth of the mine, is raised in temperature to such a degree that it absorbs the moisture and passes out carrying the moisture with it. This process continues until the mine, including the coal dust, is perfectly dry. Such a condition makes a mine ripe for an explosion.

This information was important, because it told the operators and miners when it was necessary to take the greatest precautions.

Remedies for Coal Dust

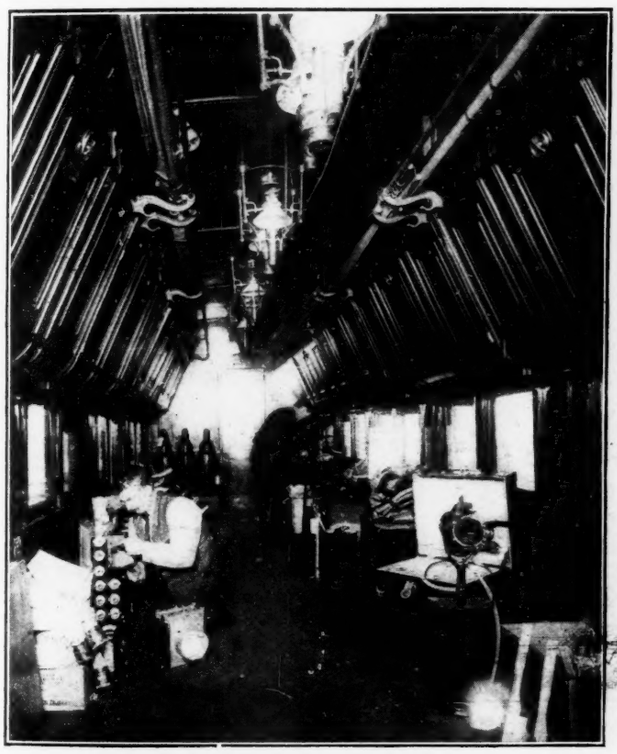
The Bureau of Mines did not stop with the declaration that dust in bituminous mines was the greatest danger, but set about at once to find remedies. These were promptly given to mine operators and miners, with the result that in many mines, excellent precautions are being taken to prevent such explosions.

The first recommendation was the use of such explosives as the Bureau of Mines declared on examination to be reasonably safe in mines where either gas or dust is found. The use of black powder in dangerous mines was strongly opposed, as in every instance where black powder was used in the experiments, it exploded the gas or coal dust. Operators were requested to use only short flame explosives in dangerous mines.

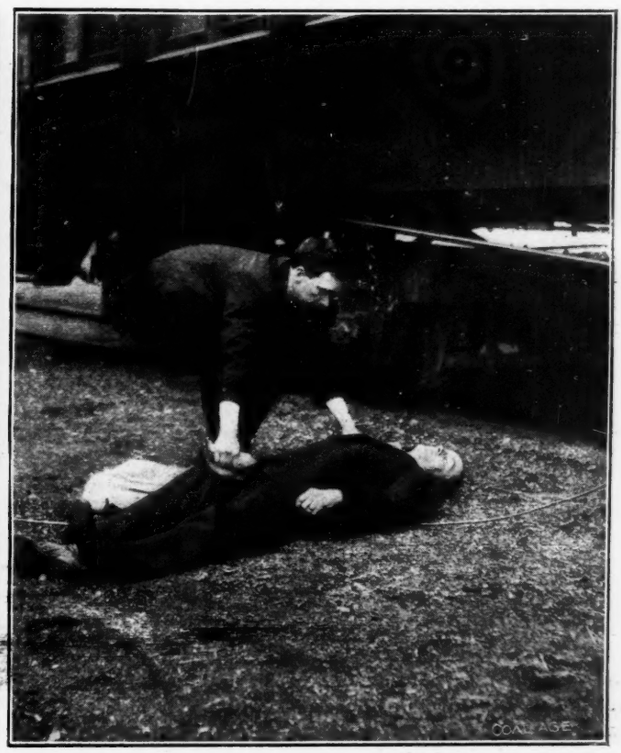
The experts also urged that all dusty mines be kept wet, either by spraying water, or turning exhaust steam into the ventilating current, keeping the air

in the mine humid. In a bulletin published and sent to miners and operators, the experts stated: "There are two ways of keeping coal dust from being dangerous. One is to wet it; the other is to mix or cover it with rock or shale dust, clay or sand. If the coal dust is wet enough it will not ignite; if there is enough unburnable dust mixed with it, a flame will not spread."

Many mine owners adopted these precautions and State mine inspectors have insisted upon their use in mines they deemed dangerous. State Mine Inspector Laing, of West Virginia, in a recent statement declared that as a result of using the explosives recommended by the Bureau of Mines and the wetting of the mines in his State, there had not been a life lost from gas or coal-dust explosions in 17 months. This record has never before been equaled in the coal-mining history of his State.



INTERIOR MINE-RESCUE CAR



RAISING MAN FROM ELECTRIC WIRE

EXPERIMENTAL COAL MINE

One of the real achievements of the Bureau of Mines has been the establishment of an experimental mine at Bruceton, Penn., 12 miles from Pittsburg, Penn. Other coal-mining countries have been talking of the necessity for such a mine for some years, but it remained for the United States to take this important step first.

The experimental mine was found to be an urgent necessity if the tests into the explosibility of coal dust and gas were to be carried to a successful conclusion. It was demonstrated in the experimental tube or gallery that coal dust would explode, but there were serious limitations placed upon the tests owing to the fear that the gallery would not stand the force of big explosions. Under the strain of certain tests at European stations, the galleries were destroyed.

Many who witnessed the coal-dust experiments at the Pittsburg station were anxious to have them made on a larger scale than is possible in experimental galleries and also to have the tests made under actual mining conditions. It is reasoned that when the exact conditions under which explosions take place are understood, tests of various preventative measures can be undertaken with some degree of precision. The experimental mine, which will soon be ready for tests, will be opened for a while in the same manner as many other mines, with all the bad practices that are found in mining—just to see what the results will be. The experts of the bureau have defined a number of these bad practices and they intend to prove in this mine that they are bad. All the remedies proposed by the engineers for removing the dangers of coal-dust explosions will be tried in the mine, in order that their efficiency may be demonstrated beyond all dispute.

A secondary purpose of the experimental mine will be a study of the explosives that have been placed on the permissible list for use in gaseous and dusty mines—testing them under actual working conditions in coal. Still another purpose will be the testing under mine conditions of gasolene motors to determine the safety of the apparatus in actual use. It is probable that many devices will be tested under actual service, and also tests made of the insulation of wiring. It is believed that the miners and operators will place more faith in the tests conducted in a mine under mining conditions than in the experimental gallery. Some have maintained that what happens in the experimental gallery does not happen in a mine.

THE TESTING OF EXPLOSIVES

It should be explained here that the Bureau of Mines has a completely equipped experiment station at Pittsburg, Penn., situated on the Arsenal grounds, Fortieth and Butler streets. Here the various explosives used in coal mining are tested to determine which are the safest to use in dangerous mines.

When the Government took up the investigation of explosives, it found such variation in the strength of the explosives and such reckless use of them in many of the mining fields that it might be said the miner took his life in his hands almost every time he touched off a fuse.

Not only were the explosives extremely dangerous in themselves through their variability, but they were oftentimes used in such large quantities as to preclude

the possibility of safety. The mortality statistics prove this contention. Fifty per cent. of all the fatal accidents and 39 per cent. of the non fatal accidents are the result of falls of roof and coal. In European countries the number of accidents from this cause is much less, which leads to the conclusion that in the United States the very great disturbing and jarring effect which the discharge of large amounts of explosives in a mine exerts is one of the most important factors which bring about the fall of roof and coal. It is believed that although the actual fall of rock or coal may not occur at the time of firing the charge, the heavy shot weakens the walls and roof, so that months after, without warning, it falls.

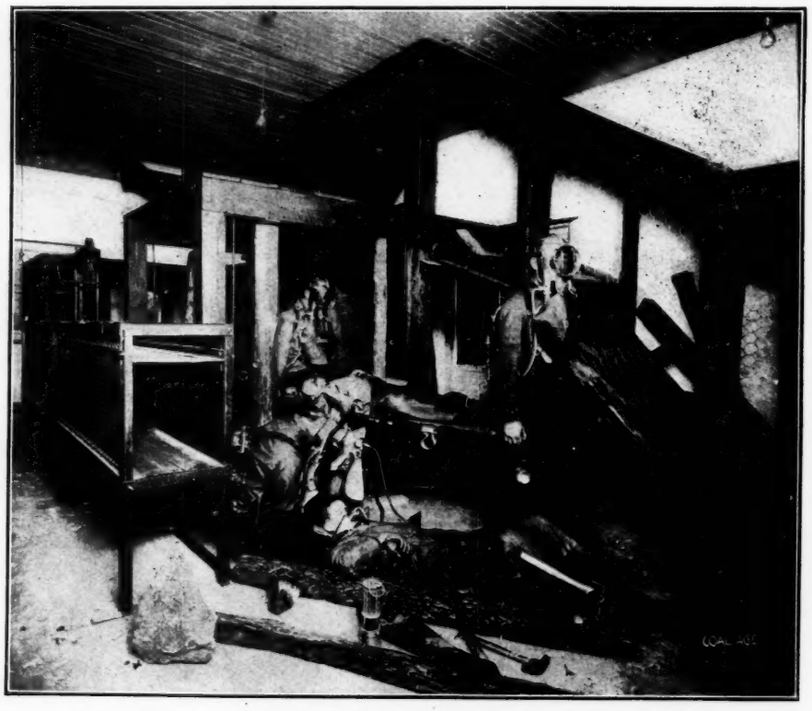
With such conditions to contend with, the Government proceeded to standardize explosives and to find out just what types were comparatively safe for use in mines that contained gas or coal dust. Manufacturers of explosives were invited to send in their explosives to be tested and they responded readily. The tests were conducted in the great steel cylinder, 100 ft. long and 6 ft. in diameter, the explosives being fired by electricity into gas or coal dust, or both gas and coal dust. Those explosives that did not ignite the gas or coal dust, after repeated trials, were passed upon as "Permissible Explosives" and recommended to the various State mining bureaus, coal-mine owners and miners, as being reasonably safe.

The tests brought out conclusively that it was exceedingly dangerous to use black powder in dangerous coal mines. In repeated tests the black powder never failed to ignite the gas or coal dust. This information was given to the operators and miners and there was the immediate abandonment of the use of black powder by many operators. It was shown to both miners and operators that with equal quantities of permissible explosives and black powder, the flame of the black powder is more than three times as long and has a duration of from 3000 to more than 4000 times that of one of the permissible explosives, and the rate of explosion is similarly slower. The length of flame is an important consideration in the relative safety of a powder, the longer flame and the flame of longer duration having just so much more opportunity to ignite the coal dust or gas.

As a result of the Government's efforts, the use of black powder in dangerous mines has been prohibited in certain States and in other States operators are using the permissible explosives voluntarily. In 1908, the coal mines used 2,000,000 lb. of short-flame explosives; in 1910 they used almost 12,000,000 lb. which is more than is now being used in Great Britain after many more years of experience. Perhaps nothing so much as these figures shows the splendid cooperation between the operators and this bureau. The continued use of the permissible explosives will have an increasingly good effect as time passes.

Mine-rescue Work

Since the bureau was organized, it has placed seven fully equipped rescue cars in the principal coalfields of the country. One car has headquarters at Wilkes-Barre, Penn., a second at Trinidad, Colo., the third at Evansville, Ind., the fourth at Rock Springs, Wyo., the fifth at Billings, Mont., the sixth at Huntington, W. Va., and the seventh at Pittsburg, Penn. In addition, the bureau maintains rescue stations at Pittsburg, Penn., Knoxville, Tenn.; Birmingham, Ala.; Urbana, Ill.; McAlester, Okla.; and Seattle, Washington.



Interior of Rescue Room at the Pittsburg Station

Each rescue car is in the immediate charge of a mining engineer, who has with him a miner trained in rescue work and another trained in first-aid-to-the-injured methods. In time of disaster, the first miner, who is the foreman of the car, has charge of all rescue work. Each station is in charge of a foreman who is a practical miner, trained in rescue work. The stations and cars have complete outfits of oxygen helmets, which permit breathing for two hours in deadly atmospheres; oxygen reviving apparatus used in bringing asphyxiated miners back to consciousness; a collapsible steel cage to take the place of one shattered by an explosion; a portable telephone for use in the mine; safety lamps, etc.

Within the last twelve months 5000 miners throughout the country have been thoroughly trained in rescue work and many have been given certificates of efficiency. These men will volunteer their services whenever there is a disaster.

Each Bureau of Mines rescue car has a specified territory over which it travels, visiting the mining camps. At each stopping place, demonstrations in the use of the oxygen helmet are given, also lessons in first aid to the injured. In the evening, the mining engineer gives an illustrated lecture to the miners on greater safety in mining. Thousands of miners have attended these lectures in the last few months and have gone back to their hazardous work with a keener sense of its dangers, a desire to be more careful and to live up to the precepts of good mining. All of this must necessarily have a salutary effect.

First Aid to the Injured

More than 5000 men are injured in the coal mines of the United States every twelve months. Some recover sufficiently to return to work, but several regiments of men are so maimed and crippled each year as to be useless to themselves and burdens to their families. Many of the injured men who are taken from the mine die later, perhaps within a few months. In quite a few instances, the death of these men or their crippling for life is due to the fact that they did not receive intelligent emergency treatment at the time of the accident.

It is to better this condition of affairs that the Bureau of Mines carries on each car, a practical miner trained in first-

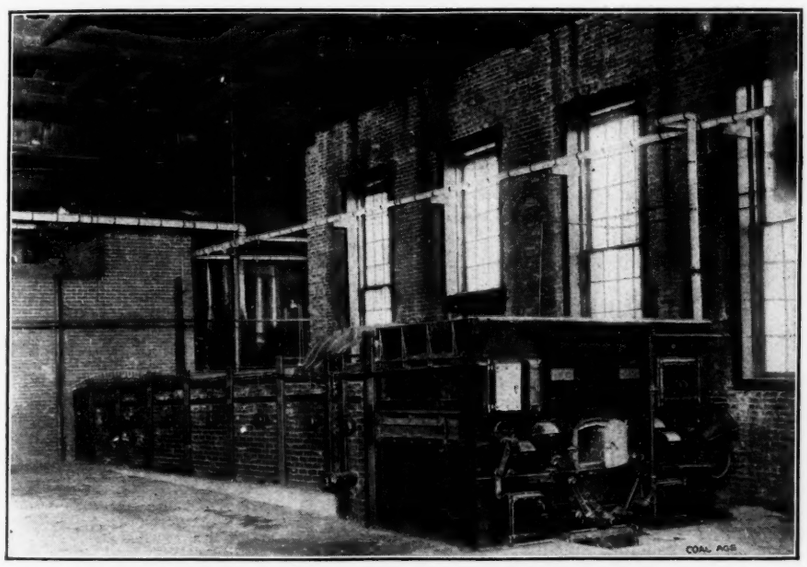
aid-to-the-injured work. This employee, while not engaged in actual rescue work, teaches the miners how to care for an injured comrade. Simple lessons in bandaging wounds and providing splints for broken legs are given at every mining camp visited. The miners are taking special interest in this feature of the work and it too promises to have an important bearing on the reduction of the death rate.

When the Government started to demonstrate the need for rescue work in the coalfields, rescue apparatus such as the oxygen helmet, which permits artificial breathing in poisonous atmospheres, and oxygen reviving apparatus to bring asphyxiated miners back to consciousness were practically unknown in the United States. Today, there are more than 300 oxygen helmets throughout the country, some belonging to the Bureau of Mines, others to State mining bureaus and still others to various coal companies. In the last two years, between 30 and 40 coal companies have purchased full rescue equipments and have crews thoroughly trained in rescue work. All of this is the result of the work of the Bureau of Mines. The Frick Coke Company, employing 30,000 men, has established a complete rescue station near Connellsville, Pennsylvania.

The Consolidation Coal Company, another big concern, has established a rescue station at Fairmont, West Virginia.

A third station has been erected at the Marianna mine in Pennsylvania by the Pittsburg-Buffalo Coal Company. Altogether it is believed 50 operators have established stations. In addition, the States of Illinois and Kentucky have established rescue stations and Illinois has mine rescue cars at its established centers. Ohio is about to equip a number of rescue stations. There are also a number of rescue cars owned and operated by the coal companies, one in the anthracite region, one in Colorado, the property of the Colorado Fuel and Iron Company, and one in Tennessee, the property of the Tennessee Coal and Iron Company.

The various rescue corps of the bureau have done valiant service at a number of disasters. Altogether it is estimated they have been instrumental in saving more than 25 lives during the year. This is the direct result. It is impossible to tell how many lives have been saved by the miners who have been trained in efficient rescue work by the Federal rescuers, and, after all, that is the real purpose of the Bureau of Mines rescue service. In many instances it is not to be expected that the rescue cars can arrive at the scene of a disaster in time to be of service, on account of the distance to be traveled, but the miners can be trained to conduct the rescue work themselves.



MURPHY SMOKELESS FURNACE HAVING LONG COMBUSTION CHAMBER

THE BUREAU OF MINES AND THE MINER

In addition to carrying the educational work to the miners at the mines by means of the rescue cars and substations, the bureau has recently begun the publication of a series of circulars written in plain, nontechnical English for the benefit of the miners themselves. Two circulars have already been issued, one describing the permissible explosives and how they should be used, and another explaining the dangers of coal-dust explosions and how to avoid them. These circulars are now in the hands of several thousand mine superintendents, firebosses and miners and they are being sent out each day to those who apply for them. That these circulars are deeply appreciated by the miners is attested by the hundreds of grateful letters that have been received by the bureau within the last few months, mostly from the miners themselves, but many from operators and owners.

The bureau is also publishing bulletins, for the benefit of the operators, mining engineers and superintendents. These publications are of a more technical nature. They, too, are in great demand.

The increasing requests for all the publications of the Bureau of Mines are a true index of the interest that is being taken in the work and also a potent evidence that conditions are improving.

THE FUEL INVESTIGATIONS

The investigation of the fuel resources of the United States is one of the serious and important problems of the Bureau of Mines. No nation can be great and prosperous without an abundant supply of fuel. Some countries have awakened to this fact too late, but the United States, with its usual foresight, has begun important investigations in plenty of time to conserve the supply. But the investigations into the waste in the mining of coal and the waste in the consumption of coal have not begun too soon. The fuel resources of this country are being used and wasted at a tremendous rate. The consumption of coal in the United States has doubled with every decade since mining began. Without a decided lessening of the present rate of coal consumption, either through more efficient use of this fuel or the extensive development of substitutes for it, the middle of the next century will find the nation's supply of easily workable coal so largely depleted as to bring serious hardships and a curtailment of manufacturing industries. The waste of the fuel resources is perhaps more serious than other resources, for the timber when gone can be replenished, the fertility of the soil can be restored, but when coal is gone, it is gone forever.

The total production of coal in 1909, the last year for which official figures are obtainable, was 460,000,000 short tons.

Investigations into the waste of coal in mining have shown the enormous extent of this waste, aggregating probably 200,000,000 tons yearly, of which at least one-half might be saved.

WASTE OF COAL IN POWER STATIONS

No accurate estimate can be made as to the total unnecessary losses in connection with the use of coal for different purposes, but lines of urgently needed investigation and inquiry are indicated by the facts that in the vast majority of the power plants of the country less than 10 per cent. of the heat units in the coal are converted into actual work.

From the 40,000,000 tons of coal which are converted into coke each year, by-products are wasted, which, if completely

saved, would have an aggregate annual value of more than the coke itself. This would include sulphate, 2,400,000 tons, sufficient to fertilize our farms, creosote for the preservation of our timber, and pitch enough for briquetting our slack coals, roofing our houses and repairing some of our roads.

It is of the utmost importance to the nation as a whole that our fuel supplies be used without unnecessary waste and with the highest obtainable efficiency, in order that it may decrease rather than increase the cost of power, heat and light to the American people, in spite of the necessary future increase in the cost of mining operations resulting from sinking deeper shafts and taking coal from thinner seams. These are the reasons for the fuel investigations of the Bureau of Mines.

The investigations which are now being conducted at the Pittsburg plant of the Bureau of Mines are being directed toward the decrease of the great waste, not only in the mining but chiefly in the utilization of the coal which the United States owns or purchases for its use. This is being accomplished by testing coals under various conditions, in various types of boiler furnaces, in pressure and suction gas producers supplying the gas for the operation of gas engines, and by making the coal into briquets and testing their efficiency in various methods of combustion. The results so far indicate that the U. S. Government, which purchases $10,000,000 worth of coal each year, and the public who buy nearly $2,000,000,000 worth, may ultimately save from 5 to 10 per cent. on their fuel bills as a result of these investigations. If the economy reached but 5 per cent. this would mean a saving of $500,000 to the Government each year and $100,000,000 to the public.

Purchase of Coal on Specifications

As a result of the plan perfected several years ago by the Technologic Branch of the Geological Survey and being carried along by the Bureau of Mines, there has been a wide awakening upon the part of the large consumers of coal and the public generally as to the best method of purchasing coal.

In the past everyone bought coal on the statement of the dealer or the reputation of the coal without asking anything in particular about the heating value or the amount of impurities in it. Now the Government and many of the large consumers are buying their fuel supplies on specifications which fix the amount of ash and moisture in the coal. Under these specifications, premiums are paid for coal better than the standard and penalties are demanded for coal below the standard. Under this system, the Government and big manufacturing establishments have been getting more nearly what they have been paying for and paying for what they get. The system is not only fair to the purchaser of coal but also to the seller, for if the latter has a high grade of coal he gets full value for it. The fuel bill of the Government now aggregates about $10,000,000 yearly, the saving on which, through securing coal containing less ash, alone amounts to nearly $200,000.

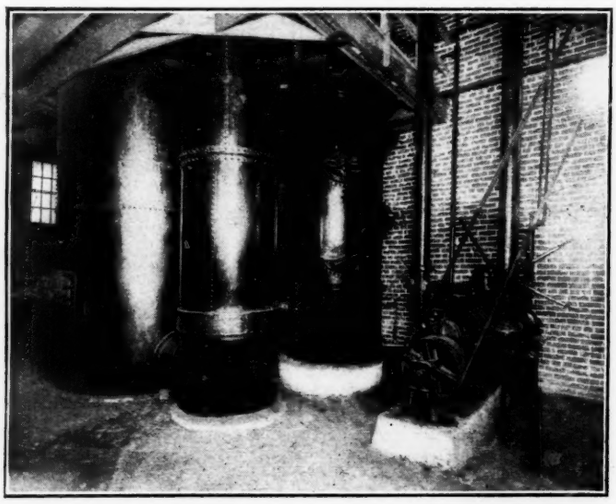
As a result of the example of the Bureau of Mines, many large corporations throughout the country are now buying their fuels on specifications. This plan has met with such high favor that fuel-engineering companies which test coals are found in practically all the large cities of the country.

The Gas Producer and Gas Engine

When the Technologic Branch of the Geological Survey began its investigations to increase the efficiency with which fuels are used, it had installed at its plant a gas producer and a gas engine of 250 h.p. The gas producer and engine were hardly known in this country at the time, but experiments in Europe had indicated the ability of the producer to turn coal into gas at little cost and to produce power through the gas engine economically.

The tests by the Technologic Branch and the Bureau of Mines have not only demonstrated that the gas producer and engine are cheap producers of power but have also shown that many fuels of such low grade as to be worthless for steam-power purposes may be economically converted into producer gas and may thus generate sufficient power to render them of high commercial value. Coals containing as much as 45 per cent. of ash, and lignites and peat high in moisture have been successfully converted into producer gas, which has been used in operating gas engines. The tremendous saving of the fuel resources of the country through the utilization of these low-grade fuels can be readily seen.

English Briquetting Machine



Gas Producer

Coal Doubles Its Service in a Producer

It has been estimated that in each test there was developed from the coal in the gas-producer plant an average of 2½ times the power which would have been developed if used in the ordinary steam-boiler plant, and that these relative efficiencies will probably hold good for the average plant of moderate power capacity, though this ratio may be greatly reduced for large steam plants of modern type.

It was found that the low-grade lignites of North Dakota developed as much power when converted into producer gas as did the best West Virginia bituminous coals when used under the steam boiler. In this way, lignite beds underlying from

20,000,000 to 30,000,000 acres of public lands, supposed to have little or no commercial value, are shown to have a large value for power development. This is of importance to the West and makes possible a great industrial development there. As a result of the investigations of the Technologic Branch of the Geological Survey and the Bureau of Mines, many large gas-producer plants have been installed throughout the United States.

The Briquetting of Coal

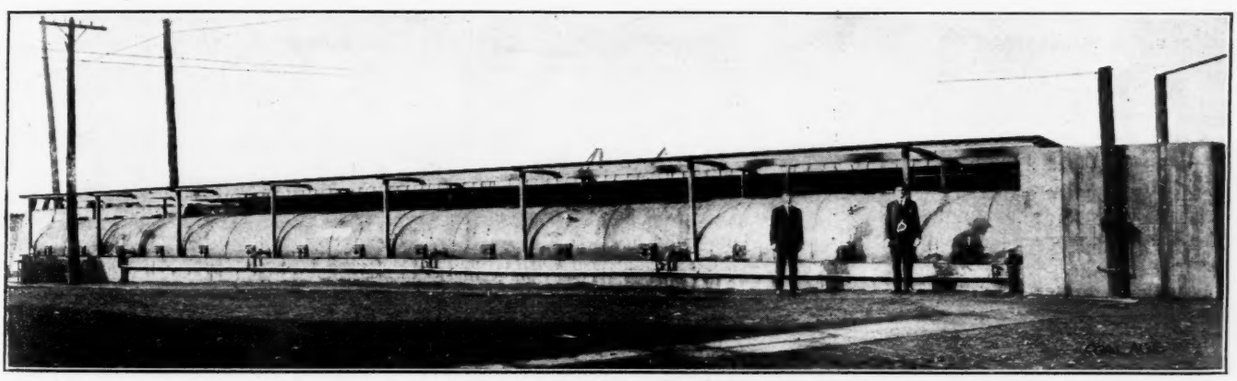
Another important feature of the work of the Bureau of Mines in conserving the coal supply, is the manufacture of briquets. These are composed of waste bituminous or anthracite coal mixed with 6 to 7 per cent. of gas pitch, the whole pressed into cakes or briquets by powerful machinery. Briquets have been used in foreign countries for many years with much success.

Briquets, in addition to affording a means of utilizing the waste coal, have a number of advantages over coal. They hold together until almost completely consumed, which gives the air a chance to get between them, making the combustion more perfect and their burning under favorable conditions almost smokeless. It has been demonstrated that they produce a hotter fire than coal because of the added fuel value of the pitch.

The tests with reference to the combustion of briquetted coal have demonstrated conclusively that by this means many low-grade bituminous coals and lignites may have their commercial value increased by an amount sufficient to more than cover the increased cost of manufacture.

These tests have also shown that the highest-grade bituminous coals can be burned in locomotives with greatly increased efficiency and capacity, and with less smoke than the same coal unbriquetted. They have shown that the same locomotive may, with the same fuel consumption of briquets as with raw coal, very materially increase its hauling value and thus reduce the cost of transportation.

The Bureau of Mines has just completed a series of briquetting tests using lignite from California, Texas and North Dakota, that promise much to the people of the West. The lignite from these States, which is a form of coal, has been of little value because it cannot be transported far from the place where it is mined. The lignite, shortly after mining, slacks and crumbles into dust. It is also difficult to burn near the mines because of the great amount of moisture it contains, sometimes as much as 30 and 40 per cent. The Bureau of Mines has succeeded in briquetting this lignite without the use of a binding material and at a cost that makes it commercially possible. Some time ago, the bureau in a series of experiments at the Reclamation Service pumping plant at Williston, North Dakota, demonstrated that the raw lignite could be satisfactorily burned under boilers, by turning it into gas. The results of these experiments mean an adequate fuel supply for the people of the Western States, where they had practically none before. The importance of these results is even further magnified when it is considered that the lignite fields are situated at great distances from the bituminous fields.



Gas and Dust Gallery No. 1, Bureau of Mines

Steaming Tests of Coal

The tests of different coals under steam boilers have also shown the possibility of increasing the general efficiency of hand-fired steam boilers from 10 to 15 per cent. over ordinary results, and if this saving could be made in the great number of hand-fired boilers now being operated in all parts of the United States, it would result in a large saving in the fuel bill of the country and a resultant conservation of the fuel resources.

The Smoke Problem

The Bureau of Mines has wielded a large influence in the abatement of smoke in the large cities of the country. It has not only given its counsel as to the best methods of carrying on a campaign against this great nuisance, but has also demonstrated to those interested that coal can be burned without objectionable smoke. Its plant at Pittsburg is a model for the entire country in regard to the absence of smoke and its experts are always willing to explain how this is accomplished.

The investigations into smoke abatement have indicated clearly that each type of coal may be burned practically without smoke in some type of furnace or with some arrangement of mechanical stoker, draft, etc. The elimination of smoke means more perfect combustion of fuel, and consequently less waste and higher efficiency.

The Chemical Analysis of Coal

Chemistry is assisting the fuel experts to determine the characteristics and the comparative value of coals throughout the country. The primary purpose of the chemical analyses made is to give the Government, and the Navy in particular, exact information regarding the various coals purchased, no matter from what field in the United States. If a naval vessel coals at Boston, these tests will enable its engineer to select his fuel intelligently and to know what it is capable of doing. This information, it is conceded, would be of extreme value in time of war.

The analyses made are of great service not only to the men who do the Government's work, but to engineers throughout the country; and under the stimulus of work of this kind the question of fuel efficiency is receiving attention in many parts of the country. Many power plants in the United States are now buying fuel on definite specifications and have obtained increased efficiency as a result of the Government's investigations.

These chemical analyses of samples of coal from all the coalfields of the United States will aid manufacturers, wherever situated, to save money in the purchase of fuel, for they will enable them to

learn where they can buy the coal that is best suited to their purposes.

The results of the chemical analyses of coal will be published by the Bureau within the next few months. To the engineers of the country and the consumers of coal it promises to be one of the most valuable and most important bulletins ever published by the Government.

Some of the Results

The Bureau of Mines, through the influence of its fuel investigations and the publication of the results, has indirectly been responsible for economies involving millions of dollars and the consequent conservation of the fuel supply of the United States.

The bureau does not by any means claim sole credit for a number of the big improvements in the use of fuels, for many individuals were at work on some of these problems before the Government took up the work, but it does believe that its general campaign of educational work and the practical results accomplished have been responsible for a quick realization of many big economic projects that might otherwise still be in the future.

Two of the most notable of these projects may be briefly described here. At the St. Louis World's exposition, the United States Steel Corporation exhibited a 5000-h.p. steam engine as the marvel of the age. At the same exposition, the Government began its investigation of the possibilities of the gas engine operating on producer gas. Today, the Steel Corporation is operating gas engines with an aggregate capacity of a quarter of a million horsepower, using the waste gases from the blast furnaces as fuel. These gases formerly went into the air, polluting it and making life difficult in the vicinity of the great furnaces. The Government has not operated its gas engine on furnace gases, but it has shown the possibilities of the gas engine as a producer of power. The power equivalent of the gas engines of the United States Steel Corporation operating on waste gases, amounts to more than 1,000,000 tons of coal yearly.

The Technologic Branch of the Survey and the Bureau of Mines have preached the use of low-grade fuels and have practised what they preached by burning practically waste fuel in the furnaces at the testing station.

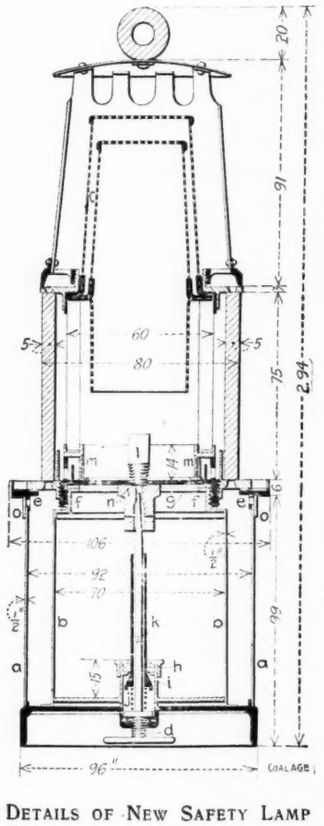
The Lehigh Coal and Navigation Company is considering the erection of a great central power plant at its mines in Carbon county, Penn. This plant, if constructed, will cost $3,000,000 and later extensions may be made involving a further expenditure of $7,000,000.

The fuel to operate this plant will come from a mountain of anthracite waste, (culm), the dump pile containing 10,000,000 tons of coal of such low grade that it cannot stand the cost of transportation. This great power plant will transform its power into electricity which will be transmitted for miles around, supplying factories, railways, shops and homes with light, heat and power.

Now that one company has started making use of the waste, or low-grade fuels, which has been urged by the Bureau of Mines, it will not be long before other plants of like nature are found at the bituminous mines of the middle West and at the lignite mines of the far West.

Acetylene Safety Lamp

At the conclusion of a paper in *Bulletin* de la Société Industrielle du Nord de la France, No. 165, in which a number of different types of safety lamps



Details of New Safety Lamp

designed for burning acetylene are described and illustrated, E. Didier dwells particularly on the construction of a lamp of this nature designed by A. Tombelaine.

The three essentials of the lamp are a cylindrical reservoir *a* for water; an interior receptacle *b*, for carbide; and the combustion chamber *c*. The water reservoir *a*, has several small holes *e*, at its upper edge, and a hole at the center of the bottom, threaded to receive the thumbscrew *d*. The carbide receptacle has a threaded ring around its top, by means of which it is tightly closed by the cover *g*, and at its bottom a valve chamber containing a felt washer *h*, a conical valve *i*, held in position by the spiral spring *j*. The pin *k*, which is a continuation of the thumb screw *d*, passes up through the valve rod, and serves to regulate the escape of acetylene through the burner *l*. The combustion chamber consists of a thick glass ring, two wire-gauze mantles, and a sheet-metal jacket, identical with the usual types of benzine safety lamps, except that the inner gauze extends downward below the outer. Air is allowed to enter through openings just underneath the glass cylinder, the orifices being so arranged with baffles and protected with gauze as to prevent a strong breeze from blowing against the flame. The lamp is locked by a fusible plug.

Method of Operation

In operation, carbide is placed in the inner receptacle, which is then screwed into place, and the bottom of the lamp immersed in water until it flows through the holes *e*, and fills the water reservoir. It then reaches the carbide chamber through the passage *n*, and the valve *i*. The amount of flow is regulated by turning the thumb-screw *d*. The object of the downward projecting gauze mantle is to prevent breakage of the glass if the flame should momentarily increase to unusual size.

In order to be able to use the lamp for detecting firedamp, the size of the flame can be much diminished by turning the thumb-screw *d*. This has the result, first, of cutting off the supply of water, and then of reducing the flow of gas through the needle valve *n*. Without the second provision, it would be necessary to wait several minutes for the generation of gas to cease after closing the water valve. Any surplus gas, after closing the needle valve, can return through the water reservoir and escape into the air. In ordinary use, the water and gas valves require but little adjustment.

The illuminating power of this lamp is about 6 c.-p., or five times that of an ordinary benzine lamp. Empty, it weighs 1.5 kg. The normal flame will last for 11 hours with a consumption of 100 g. of carbide and 150 g. of water.

The Cokedale, Colo., explosion illustrates the necessity of a mixed rescue corps, that is, a corps composed of men performing different duties in the mines. At Cokedale the rescue corps was composed entirely of shot firers and as the accident occurred at night while they were all on duty, the entire corps was either killed or severely injured, thus leaving no one trained in life saving to aid the miners and other employees trapped in the mine by the explosion.

American Mining Congress Meeting

Special Correspondence

The attention of the convention was largely directed to a solution of the present deplorable conditions surrounding the coal industry. It was the consensus of opinion among delegates that the Government should permit a better control of production and a fair regulation of coal prices.

The annual meeting of the American Mining Congress was held at the La Salle hotel in Chicago, Oct. 24 to 28, inclusive. The convention was well attended and the papers presented were of considerable interest, especially to coal men. President Taft addressed the Congress Saturday morning, Oct. 28, devoting considerable attention to the Alaskan coal-lands question. Secretary of the Interior Walter L. Fisher talked to the delegates Friday evening, Oct. 27, also occupying his time with a discussion of the coal-lands question in Alaska.

President Taft touched lightly upon the Ballinger incident by deprecating the unnecessary attribution of evil motives to those who directed the affairs in Alaska in the past, and said Secretary Fisher would earn his undying personal gratitude, as well as cause him to rejoice as an American citizen, if he put Alaska once more in untroubled waters, and in the way to a reasonable development.

The President also referred to the excellent work being accomplished by the Bureau of Mines, and paid a pretty compliment to the energy and effectiveness of Doctor Holmes, the present director.

Turning from the field of agriculture to the mining interests of the nation, Mr. Taft continued:

"So it is with respect to the mining industry; that, next to the agricultural industry, is perhaps the most important we have. It spreads over all space. It divides itself into so many different varieties and is so widespread that no one State can give to the research, investigations and general publication of results, the time, money and attention, and the number of people required, in order that we should make progress there. This is especially true with reference to the saving of the lives of miners engaged in this industry, and I am glad to note that Congress has passed a law creating a mining bureau."

President Taft then referred to the fact that in 1862 when the Homestead law was passed, the present Department of Agriculture was established. It was called a department, but the man at the head of it was not a cabinet minister, and he did not become so until many years later. The President's evident idea was to call attention to the parallelism between the establishment of the Department of Agriculture and the present Bureau of Mines, and to indicate that the growth of the agricultural bureau is likely to be repeated in the case of the mining bureau.

During the convention, interesting papers dealing with various phases of coal mining were presented by A. J. Moorshead, president of the Madison Coal Corporation, St. Louis, Mo.; Carl Scholz, president of the Consolidated Indiana Coal Company, Chicago, Ill.; D. W. Kuhn, president of the Pittsburg-Westmoreland Coal Company, Pittsburg, Penn.; G. W. Traer, Chicago, Ill., and Walter Williams, president of the Hart-Williams Coal Company. Practically all of these papers contained a plea that the Government should so modify the Sherman act that coal men might be permitted in some way, to regulate coal production and prices.

Various plans for controlling production and equalizing prices of coal were suggested: Carl Scholz called attention to the operations of the Westphalia Selling Syndicate in Germany, citing the history of this organization as one that might be profitably studied by the American people. Mr. Scholz said, "The same difficulties which now confront the coal operators of the United States were, in the early stages, experienced by mine owners in the Westphalia district in Germany. In fact, during 1870, a crisis was reached and disaster was only avoided when the German-France war brought a decided, but short-lived, relief.

A Lesson to American Operators

"The lesson to the coal operators of the United States is that Germany has faced and solved problems similar in character to those with which we are struggling." It was shown by Mr. Scholz that the sale of mining products can be handled more advantageously through an entirely separate organization managed by a firm of salesmen under the direction of the owners. This is the plan on which the Westphalia Coal Syndicate operates. The plan of the German company is buying and selling coal and coke, and acquiring mining fields and shares in mining companies. The capital is $600,000, divided into 8000 bonds of $75 each. This capitalization is based on 80,000,000 tons of production. Each member of the syndicate must acquire one bond for each 10,000 tons of annual output.

The management is intrusted to a board of two or more members elected from the directors, and twelve members, three of whom are changed each year. The managers are elected at the annual meeting of the bondholders. The tonnage allotted to each company is fixed by a commission of eight members. The syndicate buys and pays for all the coal covered by allotment. None of the product can be sold by any producer except through the syndicate. A mining company must furnish the quantities agreed to and the syndicate must market it. The mines owned by the German government have, since 1905, sold their product in competition with the syndicate. It is believed they will, later on, join the syndicate.

The chief advantage claimed for the Westphalia plan is the elimination of unnecessary and suicidal competition, and the result has been to place the coal industry in Germany on a basis which enables the operators to produce their tonnage at a reasonable profit; as a consequence, they are able to pay the miners a fair wage and furnish better protection against injury than was possible under conditions that previously existed.

An Increased Profit

The increased profit that has resulted to German coal operators since the organization of the Westphalia Selling Syndicate has warranted the better equipping of the mines with modern machinery and appliances. The advantage to the coal consumer has been the elimination of fluctuations in price by the depression of low figures in a time of surplus, and by rises to higher figures during a time of shortage. Under this plan, the consumers receive a more uniform price and the large consumer does not get a low price at the expense of the small buyer, who may be compelled to pay exorbitant figures.

The syndicate has, through the establishment of agencies, and arrangement for shipping facilities, made possible an efficiency in the marketing of coal, which cannot be reached by the individual producer.

Mr. Scholz concluded his remarks by saying: "Indicative and impressive is the inscription on the syndicate-building entrance, reading, 'Unity Makes Strength.'"

The remaining papers presented before the Mining Congress, and that are of interest to coal-mining people, will be published in the next issue of Coal Age.

National Mine Safety Demonstration

Special Field Correspondence

The Bureau of Mines, inadequately housed at the Pittsburg Arsenal, exhibits the plant where its many important investigations are in progress. Interesting and valuable demonstrations are conducted for the throng of visitors. The Bureau's present work is described and its future aims are outlined.

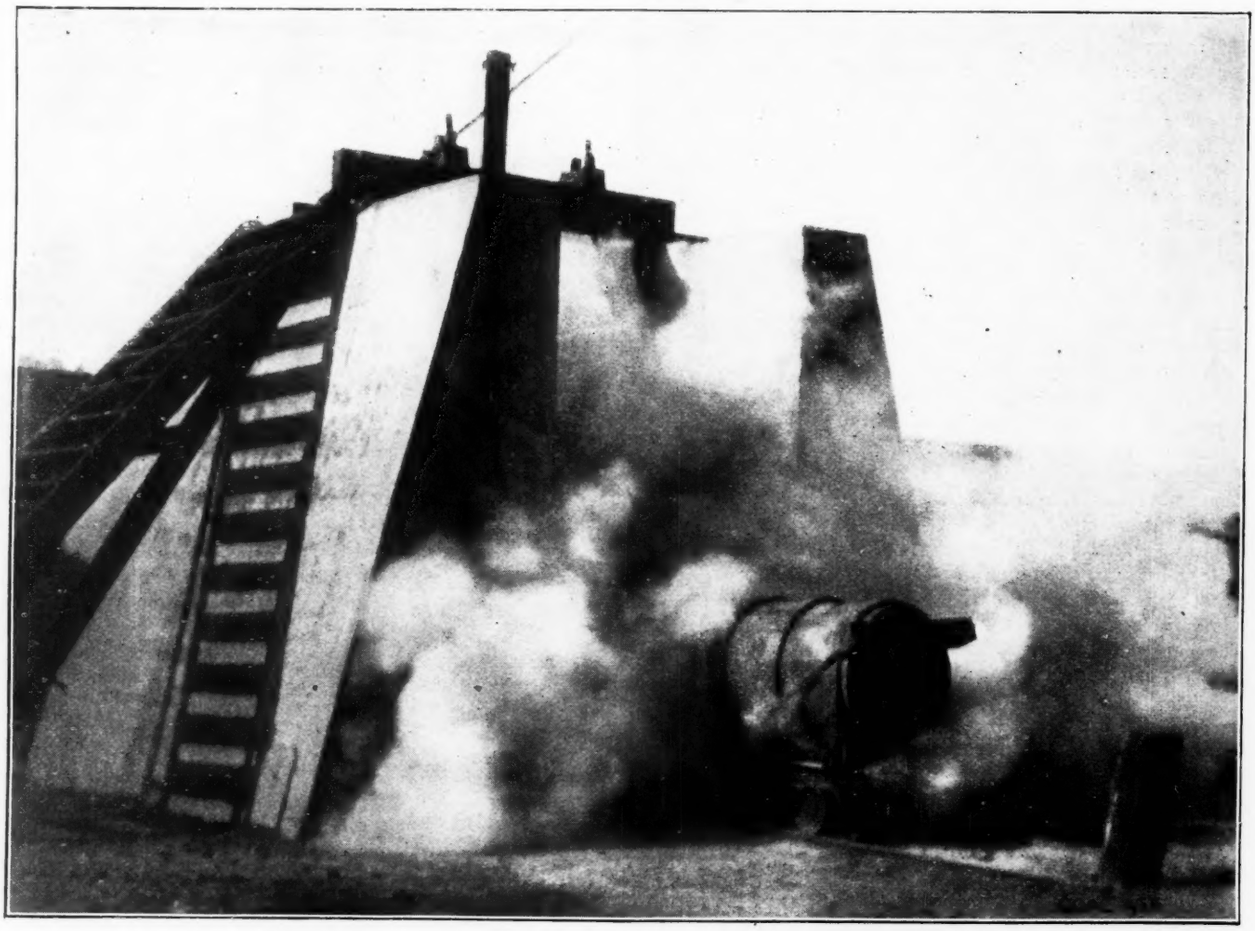
The national mine-safety demonstration has not failed to measure up fully to the expectations of the most sanguine of its promoters. Nothing is clearer than that there was nothing forced about the expression of interest of all concerned. It was not artificially augmented and fostered by any of the numerous agencies, which were the prime causes of the demonstration. The miners and the corporations are responding with ardor because "security first" is the most pronounced of all present-day mining sentiment.

The morning of Oct. 30 was spent in and around the buildings of the Bureau of Mines in the Arsenal grounds. These buildings were somewhat of a surprise to visitors who saw them for the first time, though it has generally been conceded by those who have viewed them before that they are inadequate for the purpose to which they are devoted. One felt a chill sensation as he piloted Joseph G. S. Hudson, chief of the new explosive section of the Dominion bureau of mines, Ottawa, Can., through the archway by the quaint and dingy quarters occupied by the Arsenal authorities.

These quarters, dating back to the early part of the last century, are built of old-fashioned hand-made brick. They inclose two little grassy squares. Back of the second square, set in a way economical of room, without any attempted grouping, and not facing in front or rear or sides on the lawns to which reference has been made, stand some long shed-like buildings for which the war department has no longer any use. No military force is kept at the Arsenal, the buildings facing on the two squares being used as a hospital and for the storage of quartermaster's supplies. In these inglorious buildings, at the rear, are summed up, structurally speaking, all that, after many years of agitation of congresses and institutes, the mining industry has secured from the Federal Government.

One of the buildings was once a paint shop. None ever rose to any dignity higher than a storehouse, until upon their dingy, somber fronts appeared the pretentious titles, "Bureau of Mines" and "Bureau of Standards." Concurrently, there were placed in two of them narrow passageways with cramped stalls on the right and on the left, in which the bulletins are being prepared which are being so freely quoted at home and abroad, either as the last word on uptodate mining or as lucid expositions of home and foreign researches.

To revert to Mr. Hudson, one cannot but recall that he is about to erect a $25,000 building on a lot already owned



SHOWING BALLISTIC PENDULUM IMMEDIATELY AFTER A POWDER TEST

by the government of Canada, that his bureau starts with an appropriation of $100,000, and that when that is expended the council of the Dominion expects to spend more.

When the present-day mining interests of Canada are considered and compared with those of the United States, one realizes how far less adequate is the provision of our Federal Government for safety and economic development than is the provision of the government of the Dominion. Nevertheless, Canada today has a population barely equal to the population of the State of Pennsylvania.

A new one-story red-brick shed has recently been erected to house some new experimental apparatus of the Bureau of Standards. It is to be hoped that no new buildings will rise of like kind in such a place, and that a new location, with a less restricted opportunity for development, will be found for one or both of these bureaus, and that when that happy time comes a building will be provided comparable to that erected to take care of the Bureau of Agriculture, or that part of the Bureau of Standards at Washington, D. C.

The Future Aims of the Bureau

The testing of explosives is so completely described under another caption in this same number that there is no need to elaborate on it here. The nature of the present work of the Bureau and the purposes of that work also are given in another place in this article. It is, therefore, opportune to call attention, not so much to present work and present purposes or past achievement, as to the future researches and future aims of the Bureau of Mines.

Research is not peculiar, for like all human activities, the preliminary planning rarely outlines the final resultant work. Questions in their solution involve others, so that ramifying problems spread out in several directions from what at first appears a simple inquiry.

It may be well to quote here the hitherto unpublished statement of the chief engineer, W. H. Wilson, relative to the inquires the bureau purposes to try to solve. In an address before the Coal Mining Institute of America he declared the intention of the bureau to investigate misfires and their causes, the economic use of explosives in coal and metal mining, the nature of coal dust as exhibited in the several mines of the country, the problems resulting from quarrying practice, methods of tunnel driving in metal mines, the evidences of presence and the nature of mine gases, a comparison of the laws relating to mining in the various States, and throughout the world, problems of sanitation, and suppression of smelter fumes.

But we can readily see that the bureau will eventually enter the field of physics and chemistry, in a basal way, trying to discover what are the preliminary and concomitant actions of the gases in an explosion; what transpires before an explosive gas flames and explodes; what is the real, not the theoretic, reason for high specific heats; why safety lamps are reasonably safe, and other kindred subjects. These unpopular problems of great profoundity may give rise to certain simple, practical rules, which, if observed, may make it possible to avoid explosions.

In fact, no form of knowledge, however erudite and removed from practice, is unlikely to give practical results. The early work on coal-tar products was not

First-aid Miners' Team Bandaging for Face and Neck Wounds

Two-man Event, Showing Judges Observing Speed and Efficiency of Team

A Number of Bituminous First-aid Teams during Rest Interval

Bandaging and Splinting of Man with Broken Arms and Legs

conducted to discover a sweetening substance, to prepare a coloring for dress goods or wine, to provoke a steady action of the organic functions or to relieve headache, but inadvertently it has laid bare all of these. And the public would do well to prevent pressure from being brought to bear on the bureau to be too severely practical, that is, to seek results before causes, or to hunt the place before the road thither.

Many Problems

The action of air currents on lamps of various designs the nature and methods of resistance of immunizers to explosion, the best forms of immunizers, the value of various sprinkling devices and humidifiers, the possible action of electricity and electric arcs on air, the absorption of oxygen by coal, and the slow oxidation of the latter, the peculiar nature of coking coal, causes of fluxing and caking of coals in the furnace, the effect of waste gases from oil and gas engines on the purity of the air currents, the structure of the roof, its action under stress, with all that this includes, the loads on mine timbering and steel work, the corrosion and pollution by mine waters, the best methods of complete extraction of minerals, the more favorable method of using waste gas and byproducts from ovens, the manner in which timbers may be creosoted, the destruction of various types of timber fungi, the best forms of concreting and dampproofing for mines, the prevention of overwinds and falling cages, the determining factors in the direction of an explosion, the distance an explosion will travel over dustless, wet, damp or immunized zones, or in the same direction as an air current, the speeds and pressures during an explosion, the strength of stoppings needed to resist its extension, the temperatures resulting and the means of tracing back an explosion to its primary focus and initiating cause, the possible relations of compression to forceful explosions, the possibility of explosions being caused sometimes by mine concussion, are a few of the subjects which the industry is requiring the bureau to settle, and to which it is likely that the industry will receive no answer for many years.

Unnecessary Duplication of Inquiry

It must be remembered that the Bureau of Mines is almost the only body in the United States which is doing any amount of mining-research work. In England, the work is being divided freely among the colleges and universities, and interesting results are being obtained. But here, apart from the experiments on the strength of packwalling at Lehigh University, and on the causes of spontaneous ignition, still undetermined, at the University of Illinois, almost nothing has been done toward mining-research work, except by this bureau, though not a little was accomplished at one time in ascertaining the causes of heat waste and imperfect combustion in boilers, a field which the Bureau of Mines, in its desire to conserve fuel, regards as a part of its domain.

It is to be hoped that some effectual means may before long be taken to prevent duplication of experiments in America and abroad. Although some experiments need duplication, if only for a confirmation to our own people that the results are really what they are asserted to be.

In the matter of coal dust, there are possibly more theorists in the coal field than one could believe possible. They say that they cannot see how coal dust can explode without the presence of gas. A lot of needless experimentation has been conducted in America and in England to show that it can and that it does. It is remarkable that shrewd, practical men who in all their experiences apply the pragmatic test: "Does the action happen, or does it not?" in the matter of coal dust and its ignition apply only their powers of reasoning despite the lack of evidence on which that reasoning is based, and say that what repeatedly happens in America, in England, in Belgium, in France and in Austro-Hungary, can never happen, because it contradicts the laws of nature.

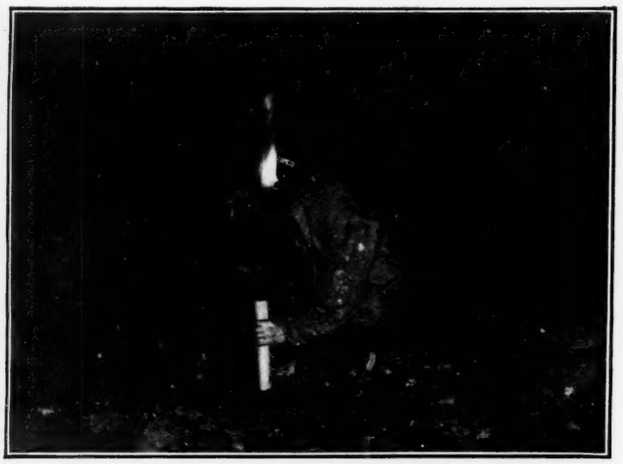
In such cases, duplication is necessary, but there is work which there is no need to repeat, and which will appeal just as forcibly if it is quoted in the bulletins of the bureau as it would if it formed a part of the actual operations of that organization. All institutions desiring to make investigations should make such intention known, that they may be allowed a clear field and leave a clear field to others. Mining investigation should be conducted as is astronomical research, across international lines, with frequent *pourparlers* between the scientists of all nations. It is reported that as a result of recent visits to the foreign stations, such an understanding has been effected.

The Inspection of the Bureau

The visitors first entered the long building on the opposite side of Butler street from the Arsenal. Here was inspected the physical laboratory, where high temperatures are measured, and physical apparatus and instruments calibrated. Experiments are proceeding on thermal conductivity at high temperatures and on the explosibility of mine gases. In another room was exhibited the bomb calorimeter, in which solid and liquid fuels are burned and their heating values (B.t.u.) determined. In the boiler room, hand-fired return-tubular boilers were shown arranged for smoke prevention, and here also were several types of domestic heating boilers, where waste, small in each unit but large in aggregate, is being studied.

A visit to the small but useful library of about 3000 volumes, conveniently situated about two blocks away from the point where they need to be used, followed and the visitors examined three rooms in which mining-engineering investigations are being made. The fuel

A Bad Practice—Opening Powder Keg with a Pick



An Illegal Act—Filling a Cartridge without Removing Lamp

laboratory was then exhibited, where proximate and ultimate analyses are made of coal, lignite, peat and coke, and analyses of mine and boiler water, ash and slag. The petroleum laboratory, the next point of call, was devoted to the inspection and analysis of petroleum. Here some interesting experiments are being made on petroleum and its products.

In two other rooms the chemical constitution of coal is under examination. The chemists are endeavoring to find the actual compounds which enter into its composition. This work is done, not by distillation and burning of coal to get the percentage of volatile matter and of ash, nor by direct chemical action on the various parts, but by the use of solvents of different kinds, which dissolve the many compounds out of the coal probably without chemical change. Thus liberated from their environment, they can be concentrated from the solvents, seen, weighed, analyzed and their individual characteristics determined. Here also Doctors Frazier and Schnelling are making some valuable researches into the nature of explosions.

In the gas laboratory, investigations are being conducted into mine air and natural gas, the possibility of converting the latter into gasolene, and the effects of noxious mine gases on the well being of men and animals. In yet three other rooms are conducted investigations into the destructive distillation of coal, its weathering and spontaneous combustion, and the power of coal to store up various gases, alien and self created, within its pores. Another room visited was the photographic laboratory.

In the last three rooms were located the chemists whose work it is to analyze black powders, dynamite and permissible explosives, to determine the stability or effective life of stored explosives and the amount of the exudation of nitroglycerin from its absorbents on storage.

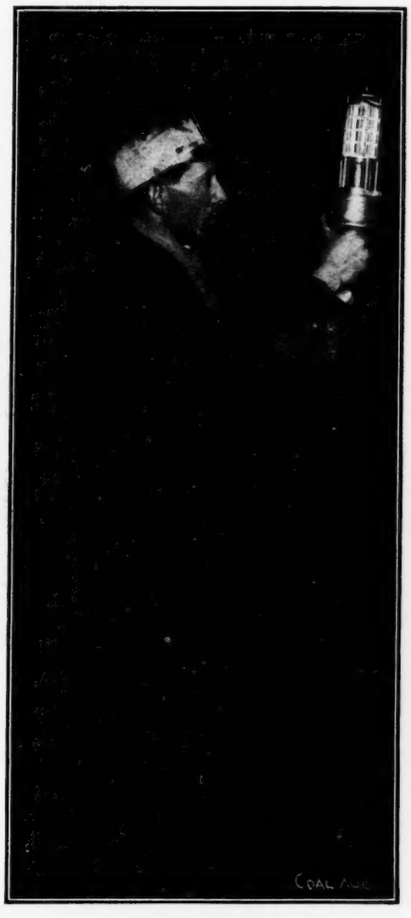
Address of Welcome

Somewhat belated, occurred the address of welcome of the director, Joseph A. Holmes, which was delivered at the rear of the Arsenal in between the motley congeries of buildings with which the reader has already been made familiar.

The guests of the bureau then viewed the testing of various incandescent lamps in an explosive mixture of gas and air. Some on being broken caused an explosion, and some did not, their relative safety being determined largely by the size of the filament, the temperatures to which that filament was heated and the speed with which the filament was burned away.

In another building, from a foundry cupola, gas samples were being taken and temperatures being observed of various horizontal zones of a coke bed. The expectation is that with a knowledge of the chemical action and intensity of heat at various levels, some information may be gained, which will make possible valuable changes in coking methods. A gas producer was also being studied, the fuel being burned at high temperature and capacity and the slag in a liquid condition, being removed by tapping.

The bureau has been experimenting on the use of limestone in this connection, to facilitate the fluxing of the slags which otherwise would clog the taphole. The smokeless combustion of low-grade fuel, high in volatile components, in a furnace fired by mechanical stokers was being exhibited in another building. If the soft-



Testing for Gas

coal man relishes but little the work for power economy, done by the bureau, the work for smokeless combustion interests him much, for by it he is enabled to draw on territory regarded as exclusively the domain of the anthracite operator and his sales agent. But above all, he looks to the bureau to encourage the sale of slack coal by these demonstrations of its efficiency and smokelessness when fed by mechanical devices.

The value of an exterior combustion chamber was then demonstrated, and the Murphy system exhibited. It is expected that the best method of making steam in a boiler will be found to be that of using an external combustion chamber; one where the progress of combustion is unchecked by the presence of large bodies of iron backed by water at relatively low temperatures. The heat in such an arrangement, being extracted in its entirety from the fuel, will be conveyed by the heated gas to the boiler. As it now is, in the ordinary boiler, the heat of partial combustion is utilized to heat water when it is more needed to complete the burning of the fuel, and thus obtain the heat units from the evolved gas and comminuted carbon.

In building No. 17, which lies at an angle to the rest, as if trying and failing to get a view of the Arsenal lawn beyond, single- and double-gauze safety lamps were tested in a current of air of known velocity containing 8 per cent. of natural gas. In another room, men wearing various types of breathing apparatus were training, in noxious gases, to perform the work of mine recovery.

The apparatus for the physical testing of explosives was then exhibited, including the large as well as the small impact machines, and the cone and pendulum friction device. In another building, a machine was running converting California lignite into merchantable briquets.

The spectacular events of the morning followed. A permissible explosive, having a strength equal to that of ½ lb. of 40 per cent. dynamite, tamped with 1 lb. of dry fireclay, was fired in the cannon of the dust and gas gallery No. 1, which was filled for the occasion with 7 per cent. of natural gas. No explosion followed, but when an exactly equivalent experiment was tried with black blasting powder FFF, the result was a violent explosion with a flame, which emerged from the end of the tube, opening every port hole in the gallery and enveloping the yard with smoke. A coal-dust explosion in miniature was exhibited in a laboratory apparatus designed for that purpose. As a final *tour de force,* in gallery No. 2, an electric mine locomotive with explosion-proof protective devices removed, on being operated in an explosive mixture of gas and air, caused a violent explosion.

The Mine Hospital

The ideal mine hospital should, if possible, be cut into the rock, and where this is not practical, concrete should be used for the walls. Such hospitals should be equipped with steam heat, hot and cold water and a sterilizing plant. Iron-doored, damp-proof closets for bandages, gauze, splints, etc., should be set in the walls. A dressing chair, dressing couch, stretcher and a first-aid kit will complete the equipment. The kit is for use at the working face, in case of serious accidents, where the patient must receive some attention before being transported to the hospital.

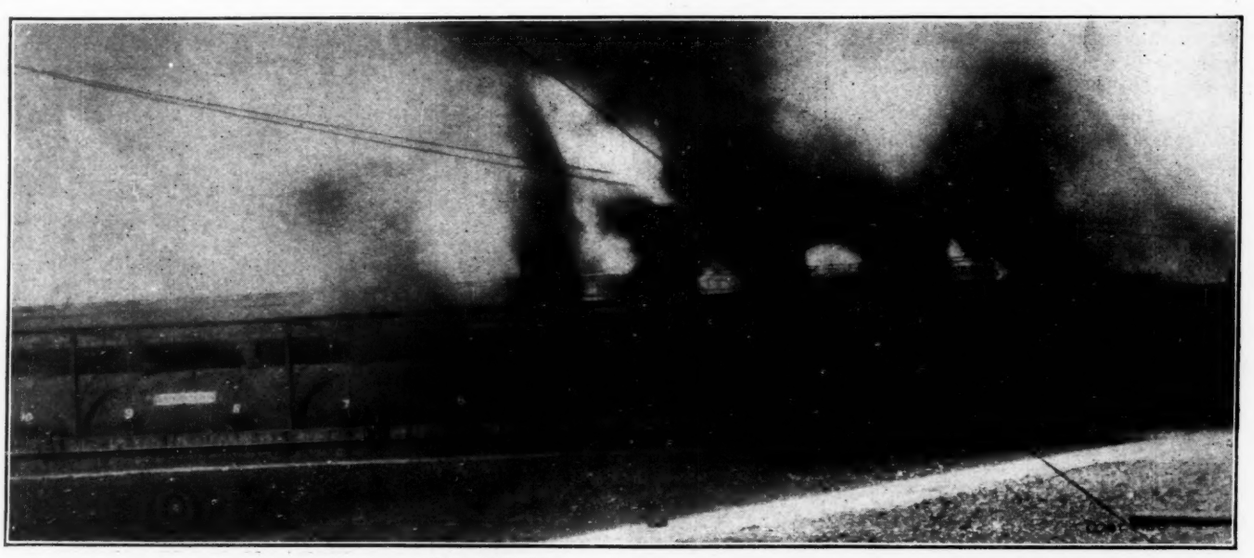
Methods of Testing Explosives

Special Correspondence

The tests of the explosives section, Bureau of Mines, are both chemical and physical. This article details the methods by which permissible powders are proved for the recommendation of the department to the mining industry.

The section of the Bureau of Mines devoted to the study and selection of explosives for use in the mines is a leading part of the Mine Accidents Division and though not more interesting than other sections is one of paramount importance in the safeguarding of the mines from disaster.

Principal among the apparatus for determining the action and acceptability of explosives is the gas and dust gallery No. 1, a cylindrical gallery 100 ft. long with a minimum internal diameter of 6 ft. 4 in. It consists of 15 similar sections each 6 ft. 8 in. long, connected by lap-riveted joints. The first three sections, those nearest the concrete head, and therefore receiving the main brunt of the explosion, are made of ½-inch boiler-plate steel; the remaining twelve sections are of ⅜-in. steel of like character, capable of resisting a tensile stress of at least 55,000 lb. per square inch.



GAS AND DUST GALLERY NO. 1, FIFTEEN SECONDS AFTER EXPLOSION

Fig. 1 exhibits clearly the form of the chamber. To the right can just be seen the concrete head within which the charge is ignited. Along the top are visible the rows of release pressure doors, one in the center of each section, each provided with a rubber bumper to prevent destruction of the door when opened violently by the force of an explosion. These doors in use can be closed and fastened by the studbolts provided for that purpose, or they can be closed and left unfastened or left open during the explosion, as may be desired.

At each of the lap joints connecting the sections and on the interior of the cylinder there is a 2½-in. angle iron making a full circuit of the internal perimeter and upon the face of this angle iron, a paper diaphragm may be placed and held in position by semicircular washers, studs and wedges. These paper diaphragms are used only to confine the gas and air mixture before the explosion.

Along the lower part of each section at its center are placed windows measuring 6x6 in., made of ¾-in. plate glass.

The natural gas used is from the distributing mains of the city of Pittsburg, a typical analysis of which is as follows:

Carbon dioxide	0.0 per cent.
Oxygen	0.2 per cent.
Heavy hydrocarbons	0.0 per cent.
Carbon monoxide	0.0 per cent.
Methane	85.3 per cent.
Ethane	11.8 per cent.
Nitrogen	2.7 per cent.
	100.0 per cent.

It has been found that the gas in the mains is of uniform percentage and furnishes therefore a reliable basis on which to compare different explosives.

The volume of gas entering the gallery is accurately measured by a meter reading to 1/20 of a cubic foot. The gas enters the required division (consisting of three sections) or divisions of the gallery near the bottom of the cylinder from a 2-in. perforated gas pipe 14 ft. long. The perforations are so arranged that an equal flow of gas is maintained from each unit length of this pipe.

Each division is further equipped with an exterior circulating system, providing an efficient method of mixing the gas with the air. For the first division this circulating system is stationary, a portion of the piping being equipped with heating coils for maintaining a constant temperature of the mixture. All other divisions have a common circulating system mounted on a truck which may be used on any one of these divisions. Valves are provided for isolating the fan, so that a possible explosion will not injure it.

The center section of each division is provided with an indicator cock, which is used for two purposes: 1. For indicators to record pressures above and below atmosphere. 2. For providing an opening where samples of the mixture may be procured. All divisions of the gallery are equipped with shelves laterally arranged for coal dust.

The cannon in which the explosive is fired is embedded in a concrete head, the axial line of the bore hole being coincident with the axial line of the gallery. The cannon consists of two parts, a jacket and a liner. The jacket is 36 in. long, 24 in. external diameter and 9½ and 7½ in. internal diameter, and is made of best cast steel, cast iron or vanadium steel. The liner is 36½ in. long, with a 1-in. shoulder 7¾ in. from the back, changing the diameter 9½ in. to 7½ in., having a smooth

bore 2¼ in. diameter and 2½ in. deep. The face of the cannon is even with the face of the concrete head.

It might be well to add that the strain on the cannon used by the bureau is considerable, for the powder used is of more strength than that used for artillery purposes. Moreover, powders for military and naval uses are made in compressed hexagons of large size so that they act slowly and continue to explode till the shot has left the cannon. If it were not for this provision none of the larger-bore guns used in military practise could withstand the strains to which they would be subjected. As it is, their life is short. Looking at these shorter cannon they seem needlessly heavy until the reason for their immense strength is made obvious by due consideration, the arguments being amply fortified by the experience of the bureau. Replacements of cannon furnish an important item of expense in the disbursements of the bureau.

The charge is fired electrically from the observation room and, that the risk of charging the cannon may be minimized, the charger carries in his pocket the plug of a stage switch (this being the only one of its kind on the grounds), so that it is impossible to complete the circuit until he has left the gallery.

That portion of the first division of the gallery which is not in concrete has a 3-in. covering, consisting of blocks of magnesium, asbestos fiber, asbestos cement, a layer of 8-oz. duck, and then a dryproof roofing and the whole covered with a thick coat of graphite paint; all this, of course, to assist in maintaining a constant temperature.

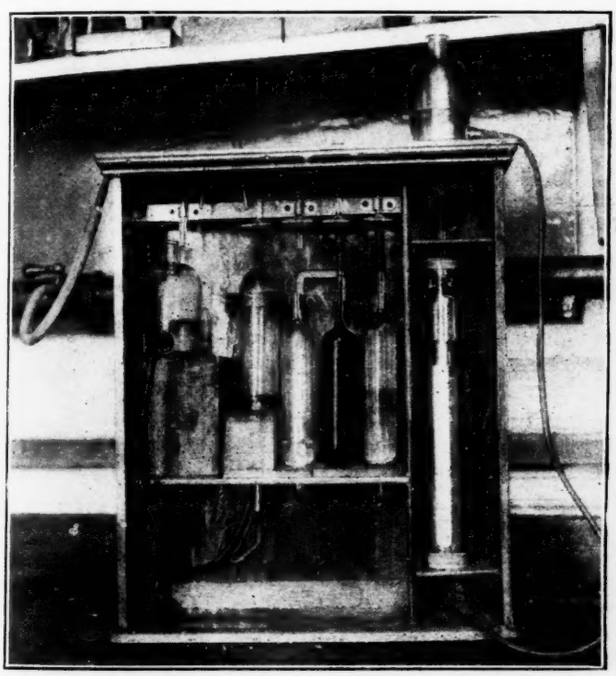
The entire gallery rests on a concrete foundation 10 ft. wide, having a maximum front hight of 4 ft. 6 in. and a minimum hight of 2 feet.

The concrete head in which the cannon is placed completely closes that end of the gallery. A narrow drain, extending under the tube its entire length, with a tapped hole at the bottom of each section, provides an efficient method for drainage.

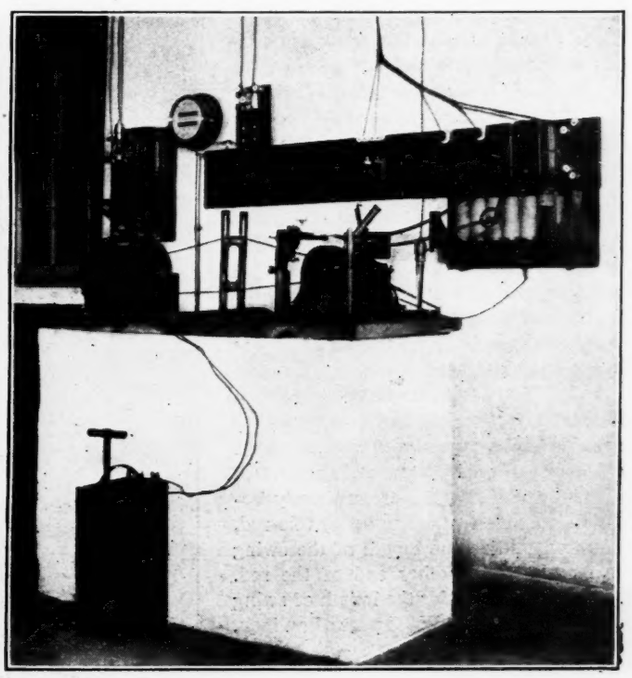
The buildings near the gallery are protected by two barricades near its open end, each 10 ft. high and 30 ft. long. A back stop 6 ft. high and 9 ft. long, 50 ft. from the end of the gallery, prevents any of the stemming from doing damage.

The tests are witnessed from the observation room, a protected position about 60 ft. from the gallery. The walls of the room are 18 in. thick and the line of vision passes through a ½-in. plate glass 6 in. wide and 37 ft. long, and is further confined by two external guards, each 37 ft. long and 3 ft. wide.

When humidity tests are run on gas and dust gallery No. 1, the apparatus is further equipped as follows: To the 14-in. doorway of section No. 1 is connected by suitable boxing a Koerting exhauster of 240,000 cu.ft. of free air per hour capacity. No. 15 doorway is used as the air inlet and to it are connected by suitable wooden boxes a compartment that contains steam radiators and the humidifiers. Three 38-in. triple-column radiators, averaging 310 sq.ft. of heating surface, are arranged with valves to control the quantity of steam flowing through them and are inclosed in a tight wooden box, approximately 2 ft. 10½ in. by 3 ft. 7 in. by 5 ft. 5 in. The air enters this box through a rectangular hole 10x12 in. in the end of box, also through 25 round holes 2 in. in diameter. A baffle board 12x19½ in. is set inside the box opposite the large opening to distribute more evenly the current of air over the surface of the radiators. The air leaves this warming box through an 11¾x30-in. opening and is carried upward by suitable boxing to a compartment 3 ft. 8¼ in. by 12 in. by 14 ft. 2½ in., which contains the humidifier heads. From there it goes through No. 15 doorway in the top of gallery, the end of the gallery being efficiently closed by brattice cloth and a paper diaphragm.



A Modified Form of the Orsat Apparatus



Apparatus Measuring Rate of Detonation

The Ballistic Pendulum

The ballistic pendulum is used for the purpose of measuring the disruptive force of a unit charge of any explosive. The unit disruptive force is defined as being that force which is required to swing the pendulum through an arc equal to that through which it is swung by a charge of one-half pound of 40 per cent. nitroglycerin mixed with the standard absorbents required by the bureau.

The apparatus consists essentially of a cylindrical weight in the form of a mortar, weighing 31,600 lb., suspended on knife edges, and a steel cannon mounted on a truck which runs on a short track. The truck is parallel with the direction of the swing of the mortar, and the cannon at the time of firing may be placed 1/16

of an inch from the muzzle of the mortar. The mortar is suspended from a beam supported by concrete walls 139 in. high, 51x120 in. at the base. On top of each wall is a base plate anchored to the wall. The knife edges rest on bearing plates placed on top of these base plates. Each bearing plate is provided with a small groove for the purpose of holding oil to lubricate the knife edges and to protect them from the weather. Each knife edge is 6 in. long and the bearing surface is rounded to conform to a radius of ¼ of an inch. The mortar rests on two U-shaped saddles which pass through heavy steel castings bolted to the beam. The vertical distance from the point of the knife edges to the center of the trunnions of the mortar is 89¾ inches.

The cannon used on the truck are similar in size and material to those used in gas and dust gallery No. 1. The truck consists of four wheels set to a 30-in. gage and the track extends about 9 ft. from muzzle of mortar to bumper.

The shot is fired from the first floor of building No. 17, about 10 yd. from the pendulum, by means of an electric firing battery. The man who charges the cannon carries a safety plug from a stage switch when working and is thus protected in the same manner as the charger at gas and dust gallery No. 1.

A recording device is placed at the back of the mortar, and is connected to it by means of a horizontal rod at the end of which is a circular face. A lug inserted in the bottom of the mortar directly below its center of gravity pushes this rod, thus transmitting the length of the swing to a scale at the other end of the rod. By means of a vernier the length of swing is recorded to the 1/200th part of an inch.

Trauzl Lead Blocks

The Trauzl lead-block test is the method adopted by the Fifth International Congress of Applied Chemistry as standard for measuring the unit disruptive force of explosives. The unit disruptive force of explosives thus tested is defined as the force required to enlarge the bore hole in the block an amount equivalent to that produced by 10 grams of standard 40 per cent. nitroglycerin dynamite stemmed with 50 grams of dry sand, under standard conditions as produced with a tamping device. The result of these tests when compared with those of the Bichel gage indicates that for explosives of high detonation the lead block is quite accurate, but for slow explosives the expansion of the gas is not fast enough to make comparative results of value, the gases escaping from the bore hole in the block rather than taking effect in causing its expansion.

The lead blocks are cylindrical in shape, 200 mm. (7.88 in.) in diameter and 200 mm. high. Each has a central cavity, cylindrical in shape, 25 mm. (0.988 in.) in diameter and 125 mm. (4.925 in.) deep, in which the charge is placed. The blocks are made of desilverized lead of the best quality and as nearly as possible under identical conditions. The charge is placed in the cavity and prepared for detonation with electric exploder and stemming. No yoke is used and no additional attempt is made to further confine the charge. The bore hole after the explosion is pear shaped, the size of the cavity depending not only upon the disruptive power of the explosive, but also upon its rate of detonation as described above. The size of the bore hole is measured by running in water from a burette until the cavity is just full. The difference between the original size of the cavity and its size after detonation is of course the enlargement produced by the explosion.

Ballistic Pendulum for Determining Disruptive Force of Powder

The Explosion Calorimeter

The explosion calorimeter is designed to measure the quantity of heat given off by detonation of explosive charges of 100 grams. The apparatus consists of a calorimeter bomb, the inner receiver or immersion vessel and wooden tub, a registering thermometer and a hooking frame.

The bomb is bottle-shaped, of ½-in. wrought steel, and has a capacity of 30 liters (31.7 quarts). On opposite sides near the top are bored apertures, one for the exhaust valve, for obtaining a partial vacuum, measured by about 10 mm. (0.39 in.) of mercury column, after the bomb has been charged; the other for inserting the insulated plug through which passes the fuse wire for igniting the charge. The bomb is closed with a cap, by means of which the chamber may be made absolutely air tight. The bomb weighs 158 lb., is 30 in. high with the cap on, and is handled to and from the immersion vessel by means of a small crane.

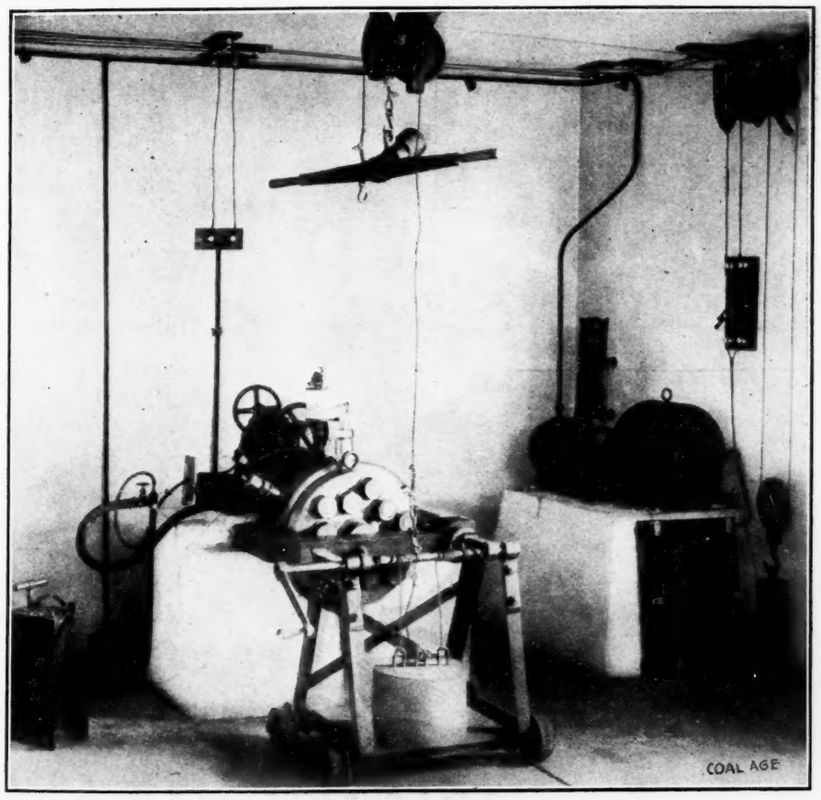
The inner receiver is 30⅞ in. deep, 17⅞ in. inner diameter, and is made of 1/16-in. sheet copper, nickel plated, and strengthened on the outside with bands of copper wire. The outer tub is 30 in. deep, 21 in. inner diameter, is made of 1-in. lumber, and is strengthened with four brass hoops on the outside.

The stirring device consists of a small wooden beam connected to a system of three rings, having a horizontal bearing surface, and is operated vertically by means of a worm gear run by an electric motor. When the apparatus is put together the inner receiver rests on a small standard on top of the base of the outer tank. The rings of the stirring device run between the bomb and the inner receiver. The bomb itself rests on a small standard placed on the bottom of the inner cylinder. The apparatus is provided with a snugly fitted board cover.

The rise in temperature of the water is read from a Centigrade thermometer measuring to the one-hundredth part of a degree. The hight of the mercury column is read by means of a magnifying glass.

The bomb is charged from the top, the explosive being suspended in the center. The caps are then screwed on, the apparatus set together as above described, first, however, exhausting the air to the desired degre of rarefication.

The apparatus is assembled on scales before the water is poured in and the weight taken, and then it is weighed after the receiver is filled with water. By obtaining the weight of the water in this way and knowing the temperature, the calorific value may be computed. The capacity of the inner receiver is about 70 liters (74 quarts). The charge is exploded by electricity while the water is being stirred. By combining the quantity of heat of the explosive in calories with the specific heats of the products of combustion at the proper temperatures the maximum temperature of explosion may be arrived at.



BICHEL PRESSURE GAGE, MEASURING PRESSURES FROM COMBUSTION OF EXPLOSIVES

RATE OF DETONATION APPARATUS

This apparatus for measuring the rate of detonation is used to determine the velocity with which detonation travels through a given length of an explosive. For this purpose the explosive is placed in a long galvanized iron tube 38 mm (1.496 in.) in diameter and 1.22 meters (4 ft.) in length and suspended in a pit. This pit is 11 ft. deep, 16 ft. in diameter, and is provided with a steel-plate casing backed by a cushion of sawdust and with a heavy cover consisting of large timbers, covered by reinforced concrete, and anchored to the ground with eight deadmen. By means of electrical connections at each end of the tube connected to the recording device known as Mettergang's recorder, placed in an adjacent building, the interval of time elapsing between detonation at the two ends of the tube is accurately measured on a smoked drum revolving with a known peripheral speed. In using such small lengths of explosive as one meter it is obviously essential that very minute differences in time be recorded. The recording device is conveniently equipped in such a way that one one-hundredth part of a millimeter may be measured. The drum is 500 mm. in circumference and its normal speed is 86 revolutions per second. The smallest time interval that can be measured, therefore, is 1/4,300,000 sec. The usual length of explosive used is one meter and the sticks of explosive are, after cutting off their ends, placed end to end.

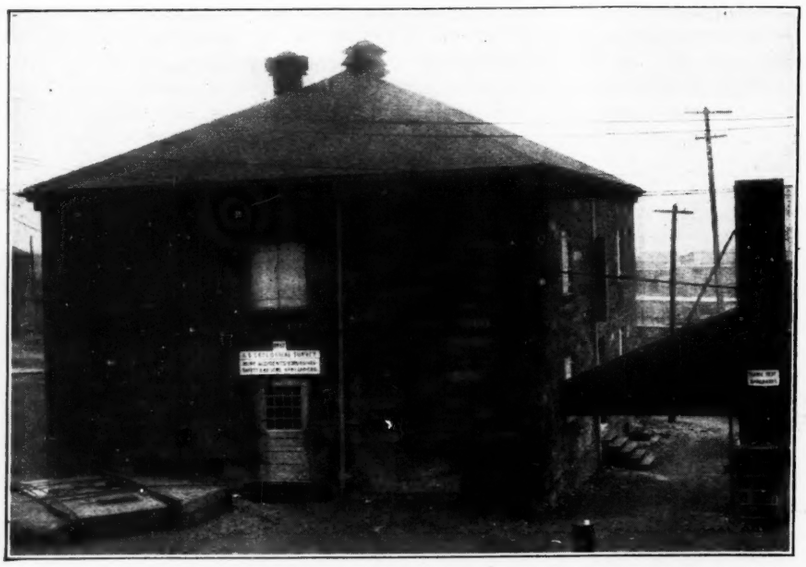
FLAME-TEST APPARATUS

The flame-test apparatus was designed for measuring the length and duration of flame given off by explosives. It consists essentially of a cannon, a photographic instrument and a drum geared for high speed, to which a sensitized film may be fastened. About 13 ft. from the outside wall of the building in which the test is observed is set the foundation for the cannon and incasing cylinder or shell. Set on top of this is a cannon identical with the one used for the gas and dust gallery No. 1, the details of which are included in the description for that apparatus. The shell or cylinder is set on top of the concrete and is concentric with the cannon, and is 43 in. internal diameter, 20 ft. high, constructed of ¼-in. boiler plate in 24 sections and made absolutely impenetrable to light on the sides and base. Riveted to the shell and connecting it with a dark room in an adjacent building is a light-excluding conduit of rectangular cross-section, 12 in. wide on the inside, horizontal on the bottom, sloping on the top from a hight at the cylinder of 8 ft. 3 in. to 21 in. at the inside of the wall of the building. It is carefully insulated from light by means of oakum packing at the joints in the building, and when not in use two small steel doors isolate the dark room from the light leaking from the top of the shell. A vertical slit is cut in the shell 2 in. wide and 8 ft. long coincident with the center line of the conduit. A vertical plane drawn through the center line of the bore hole of the cannon and of this slit, intersects the center line of the quartz lens, the center of the stenopaic slit immediately in front of the film and the axis of the drum on which the film revolves. The photographic apparatus consists of a shutter; a quartz lens placed in such a position as to focus the rays of light, including the ultra-violet rays, which are those attending extreme heat; a stenopaic slit between the lens and the rotary drum, 76 mm. (3 in.) long and 1.7 mm. (0.067 in.) wide; a rotary drum 50 cm. (19.68 in.) in circumference and 10 cm. (3.9 in.) deep, geared to and driven by a 220-volt motor, which is connected to a tachometer reading in both meters per second and revolutions per minute. A maximum peripheral speed of the drum of 20 meters (65.62 ft.) per second may be obtained. The speed is regulated by a rheostat. The drum, gears, shutter, lens, stenopaic slit and connecting apparatus are inclosed in a box which excludes all light, for convenience in order that the film may be left on the drum in position should the operator desire to leave the dark room. One hundred grams (0.22 lb.) of the explosive are used in the cannon and the firing line extends from the cannon to the dark room, from which place the shot is fired. The firing line is equipped with a stage switch as a precaution.

With the drum at rest the flame is shown on the film as a vertical line of a width equal to the stenopaic slit and by simple proportion the exact hight of the flame may be determined. When the drum is in rapid motion of known velocity not only the hight of flame but the duration may be computed by measuring the lateral displacement on the film and applying it to the known peripheral speed.

The Impact Machine

The impact machine is designed to determine the sensitiveness of an explosive to shock. For this purpose a drop hammer is used, constructed in such a way as to meet the following requirements: 1. The necessity for having a substantial unyielding foundation, of constant temperature. 2. Minimum friction in the guide grooves so as to approximate the conditions of a freely falling body. 3. Prevention of escape or scattering of the explosive when struck by the falling weight.



Flame-test Apparatus Measuring Duration and Hight of Flame

The apparatus consists essentially of the following parts: an endless chain working in a vertical path operated by electricity and provided with two lugs equally spaced; a steel anvil upon which the charge of explosive is placed; a steel stamp pressing on top of the charge and holding it in position; a magnetizing collar operating freely in vertical guides and provided with small jaws in the rear so placed that the lugs of the chain engage them; a steel weight which operates loosely in vertical guides and is drawn by the magnetizing collar to determinable hights when the machine is in operation; a demagnetizing collar which may be set at known hights and which is provided with a release for the jaws of the first collar, and a recording device geared to a vertically driven threaded rod which sets the demagnetizing device and thus determines the hight of fall of the weights.

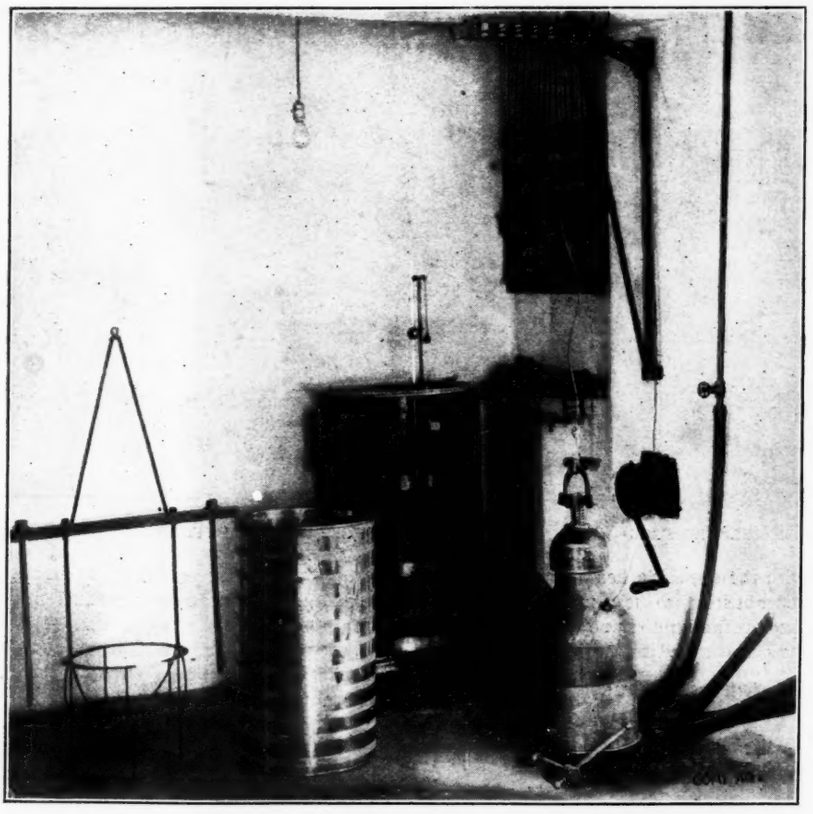
The apparatus is supported by a concrete pedestal which is set at a convenient hight for the operator. The heavy oval-shaped steel base of the machine itself is anchor-bolted to this pedestal and into the base is screwed the anvil on which the charge of explosive is placed. The main standard of the apparatus is about 65 in. high and 2¼ in. diameter, shrunk into a flanged collar which is screwed into the base plate at the rear. The collar guides are ⅝-in. rods and extend from a plate securely fastened to the top of the flanged collar at the base of the main standard to the plate of the apparatus. The steel stamp which transmits the blow of the fallen weight is 7½ in. high, 1⅛ in. in diameter, tapered at the base to a small cylinder ⅜ in. high and ⅜ in. in diameter, which operates at the center of the anvil. The drop hammer weighs 2000 grams (4.41 lb.) and moves in loose-fitting guides which produce a minimum of friction. The hammer is dropped from varying hights until detonation takes place. A maximum safety hight is determined when five attempts to explode a charge fail at that hight, and if five or less than five attempts at that hight plus one centimeter, (0.39 in.) give at least one explosion.

Care is taken that the anvil and stamp are well cleaned after each test. The whole apparatus when not in use is covered with oil and provided with a hood.

In order to maintain a uniform temperature while experimenting, water at a temperature of 25 deg. C. (77 deg. F.) flows through the anvil.

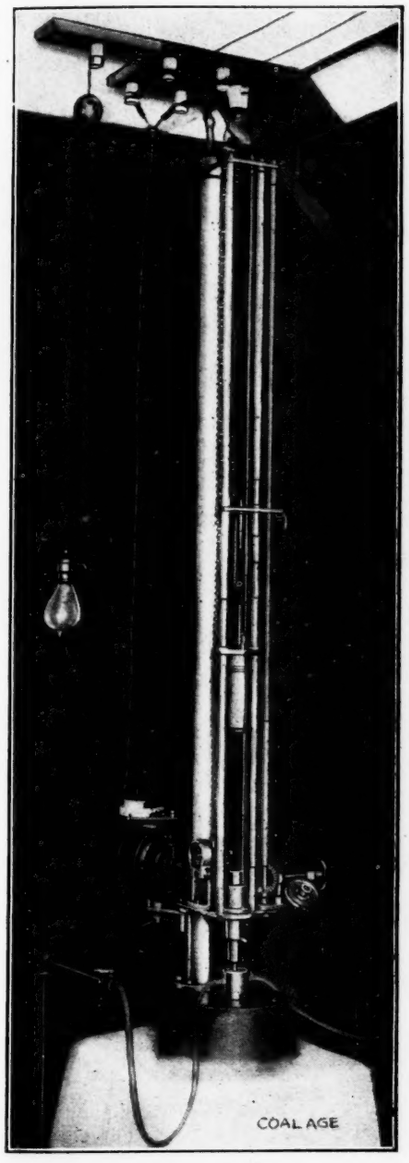
The Explosion by Influence Tests

For explosion by influence the pit described when detailing the apparatus for testing the rate of detonation is used, and two sticks of each explosive are required. The sticks are placed end to end, separated by a certain distance, always a multiple of one inch, and the pair suspended in a vertical position. The lower stick



Calorimeter Used to Determine Heat of Combustion of Explosives

is detonated. This detonates or fails to detonate the other, the action or failure to act depending upon the distance between the sticks and the sensitiveness of the explosive to detonation in this manner. The maximum distance of explosion by influence is established if the second stick explodes at that distance and fails to explode three times at that distance plus one inch.



IMPACT MACHINE

RATE OF BURNING OF SLOW EXPLOSIVES

The test of the rate of burning of slow explosives is performed in the same pit and the explosive is placed in a water pipe having an inside diameter of 1½ in. One end of this pipe is closed with a plug, the other end being free. The fuse is placed in the free end and the explosive burns toward the plug. Insulated annunciator wires are placed through the explosive one meter apart and the time of burning is indicated by sparks on the Mattergang's recorder, but the time interval between the sparks is taken by means of a stop watch.

Care is taken that the density of the explosive is normal.

BICHEL PRESSURE GAGES

The Bichel pressure gages are used for determining the strength of explosives by measuring pressures developed in an inclosed space in which an escape of generated gases is rendered impossible. The apparatus consists of a stout steel cylinder which may be made absolutely air tight, an air pump and proper connections for exhausting the air in the cylinder to a pressure of 10 mm. of mercury, an insulated plug for providing the means to ignite the charge, a valve by means of which the gaseous products of combustion may be removed for subsequent analysis, an indicator and drum, with proper connections, for driving it at a known speed.

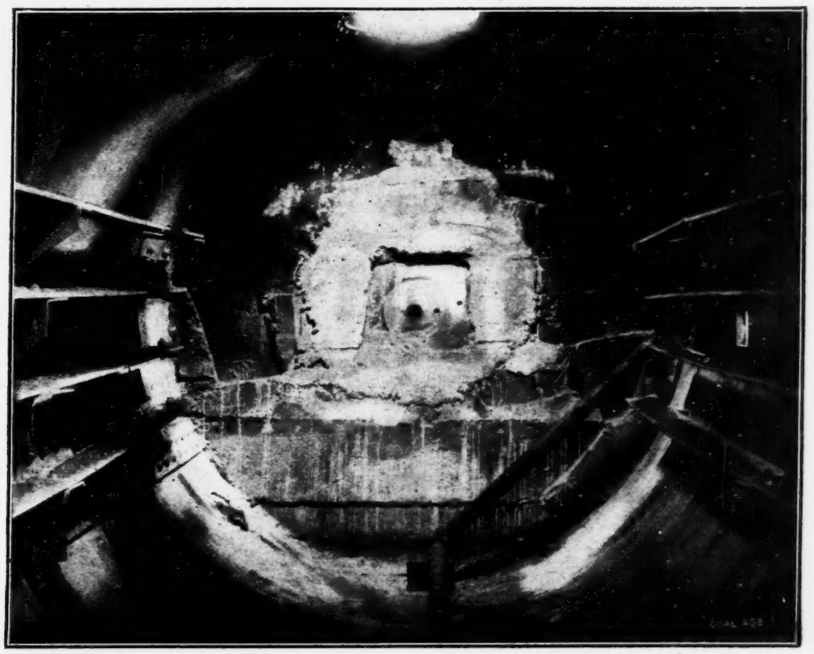
The cylinder rests on a solid concrete footing at a convenient hight for handling. It is 31½ in. long, 19¾ in. diameter, and anchored to the footing. The explosion chamber is 19 in. long and 17⅞ in. diam., having a capacity of exactly 15 liters (1585 quarts). The cover of the cylinder is a heavy piece of steel held in place by heavy steel studs and nuts and a yoke.

The charge is placed on a small wire tripod, and connections are made with a fuse to an electric firing battery for igniting the charge. A near-vacuum is produced by means of an air pump in order to more closely approach the conditions of a tamped charge exploding in a bore hole inaccessible to air. When the charge is exploded a record is made on the indicator card. This shows a rapidly ascending curve for quick explosives, grading into a shallower curve slowly rising for explosives of slow detonation. When the gases cool, the curve merges into a straight line, which indicates the pressures of the cooled gases on the sides of the chamber.

FINDING PRESSURE OF CHARGE

Since the volume of the chamber is nearly 75 times that of the volume of the charge, the pressure of the charge confined in its own volume may also be found. The cooling influence of the inner surface upon the gaseous products of combustion is a vital point in computing the pressure developed by an explosive. Its effect is eliminated by comparing the pressures obtained in the original cylinder with those of a second cylinder of a larger capacity into which has been inserted one or more steel cylinders, thus increasing the superficial area while keeping the volume constant. By comparing the effect of the increased cooling surface with the original a curve may be plotted which will determine the actual pressures developed after the elimination of the surface influence.

The black-powder separator is made similar to the separators used in powder mills, but of reduced size.



CONCRETE HEAD, CANNON, DUST SHELVES AND DISTRIBUTING GAS PIPE IN GALLERY NO. 1

Illustrations of First Aid Work

By M. J. Shields*

Describing in detail the most approved methods of treating injured miners. The illustrations present actual work performed in the Government mine at Bruceton, Pennsylvania.

*First Lieutenant, M. R. C., U. S. A., American Red Cross Society.

The illustrations with which this article is accompanied are representations of actual work performed in the Bruceton mine, of the U. S. Bureau of Mines. The patient in Fig. 1, is supposed to have a compound or open fracture of the arm, with bleeding. The first thing to do is to raise the forearm so that the elbow is bent. Elevating the arm tends to stop the bleeding, by decreasing the pressure in the veins, and this in itself eases the pain.

The Red Cross tourniquet is being applied. This is a simple affair; nothing more than a straight and strong piece of webbing, which is passed around the arm, and which is secured by a clasp, having small teeth. When the clasp closes on the webbing, a strong spring holds it firmly in place. The pressure on the blood vessel is attained, as will be seen, by placing a small block over the artery to be compressed; the artery in this case of which the circulation is to be stopped is the "brachial" or main artery of the arm, which runs in a course corresponding to the inside seam of the shirt of the patient when in place.

The hemorrhage is now stopped, and it is necessary to attend to the fracture. But first observe how carefully the attendant on the left is supporting the arm of his patient (Fig. 2) with a deft placement of his own forearm, so that the fracture is not aggravated. At the same time, he places his left thumb on the bandage to hold it in place while his companion applies the pressure.

The wound is first covered with aseptic gauze, to keep infection away, then the arm is bandaged to keep the gauze in place. This bandage is light, and care must be taken not to have it unnecessarily thick where the splints will later come. The splints, which consist of boards 3/8 of an inch thick and about 3 in. wide, are applied to both sides of the arm, these boards or splints being padded with cotton.

Splints Are Made of Yucca Wood

It might here be said that the splints preferably used are made of Yucca wood, which is brought from California. The wood is soft and easily bent to fit the arm, especially when it has not been kept in too dry a place. The inside splint extends nearly to the ends of the fingers, so that the last joints can be passed down over the end of the splint, if the patient so desires. The splints should always be long enough so that they will extend well beyond each side of the fracture, but, of course, it will often happen that the first-aid man will find himself unable to find splints of the kind here described, in which case he will avail himself of any stiff piece of wood, whether it fits the arm or not, but he will bear in mind that the primary consideration is that the splint shall effectually span the fracture. After this, either triangles or bandages are applied to hold the splints in place. The pain of a fracture is usually relieved by a well applied splint.

The arm is then placed in a flexed position, with the thumb pointing toward the nose of the patient, as shown in Fig. 3. One point of the triangle is thrown over the left shoulder, and the body of the bandage is permitted to fall over the front of the patient between his stomach and his arm. The point which is now lowest is folded back over the outside of his arm and passed over his right shoulder, and tied to the other point at the back of his neck. The third point now projects untidily from the end of the elbow, and should be folded over and pinned so as to secure the elbow in place as indicated in Fig. 4.

Fracture of the Rib

The patient in Fig. 5 has fractured his rib. The man on the right is aiding the patient to hold up his arms. The patient is told to expire or throw out his breath, so that his chest will be reduced in girth. By this means, the bandage when applied will be tight. A wide, or 6-in., bandage is used, and the pressure on his side keeps his broken bone or bones in place. When a man has a fractured rib, he instinctively holds his hand over the fracture to prevent the motion which results from the inspiration and expiration of his breath.

Treatment of Facial Burns

The patient in Fig. 6 is supposed to be the victim of severe facial burns. His shirt is opened in front by the attendant and tucked into a roll all around his neck, so that the bandaging may be made to cover every burned part. Very little is done to clean the head of the patient. If any particles of dirt are seen, they can be removed if it can be done without

Fig. 1. Showing Patient with Compound Fracture of Arm

Fig. 2. Attendant Supporting Fractured Arm of Patient

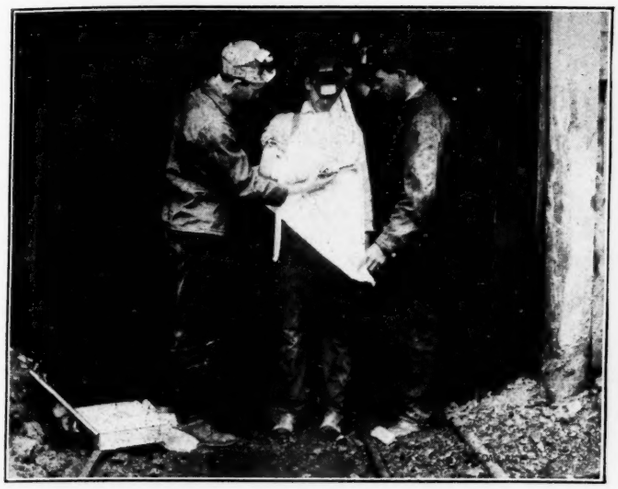


FIG. 3. THE ARM IS PLACED IN A FLEXED POSITION

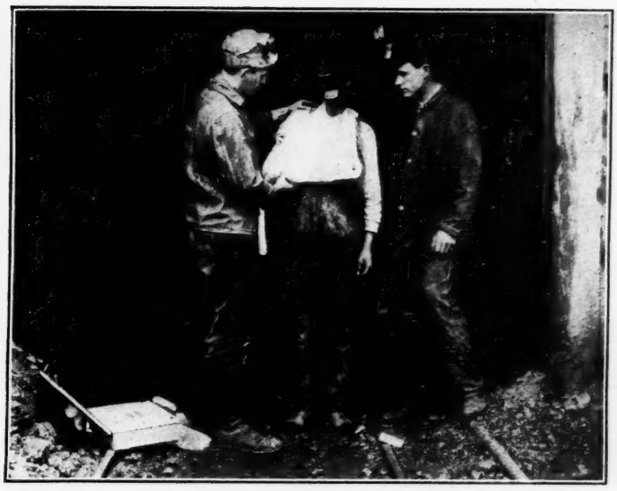


FIG. 4. METHOD OF SECURING THE ELBOW IN PLACE

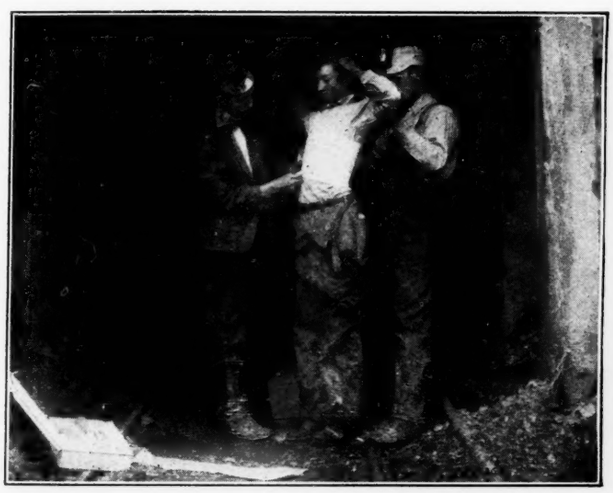


FIG. 5. ATTENDING A FRACTURED RIB

FIG. 6. PATIENT WITH SEVERE FACIAL BURNS

FIG. 7. DRESSING A SCALP WOUND, USING ONLY EMERGENCY KIT

FIG. 8. SHOWING THE USE OF PULMOTOR ON AN ASPHYXIATED MAN

dragging or fingering of the wound. If the skin is burned to the clothing, it is not dragged off, but cut away with shears. Nothing is allowed to come in contact with the burn until the gauze is put on, and this is done soon, for delay means infection and shock. The patient is told to close his eyes, if infection has not already caused him to close them.

A large piece of picric-acid gauze is moistened either with steam, if that is obtainable, or with clean water. This should cover the burn completely. As the eyes and nose are burned, no holes should be left for them to project through the dressing. The patient can breath through the bandage and picric-acid gauze without difficulty, and it is essential, not only for his comfort, but also for the rapidity of his recovery, and for the avoidance of blood poisoning, that no portion of the burned cuticle shall be subjected to the germs with which the atmosphere is everywhere loaded. The acid warms the wounds and makes them more comfortable.

Holding a burn before the fire causes it to cease its smarting. In a like manner, picric-acid gauze comforts the wearer who is suffering with burns. Moreover, picric acid is aseptic and prevents infection. Care must be taken, however, that the picric acid does not come in contact with the uncovered eyeball; otherwise it will occasion some distress to the patient.

By throwing one point of triangular bandage over the head, the other two points can be passed around the neck in opposite directions to meet at the back and cross so as to keep the first point in place. They can then be made to re-encircle the neck, and can be tied in front. This completely protects the wearer if the burns do not extend any distance toward his breast.

Dressing a Scalp Wound

Fig. 7 illustrates the use of the Red Cross first-aid compress-bandage dressing on a scalp wound on the right side of the head (temple). The compress dressing is a 4-in. bandage, with a gauze pad of 10 thicknesses sewn in the middle, which, when first taken from the first-aid packet, is folded in accordion pleats, so that when the attendant grasps it at either end and pulls, the compress remains in the center. Notwithstanding that his hands may be dirty and unclean, they can do the patient no harm, because it is not necessary for his hands to touch the wound or the compress itself. The bandage is passed twice around the head vertically, then crossed and passed around the scalp horizontally, over the temples. The attendant is shown making the final tie.

Finally the triangular bandage is placed over the head, but the method by which this is accomplished is not shown in the illustration. Two ends of the triangle are carried around the head and tied in front. If there is any bleeding, you can arrange the knot so that it is right over the source of the blood, which is oozing from the injured part, and, by drawing it tight, you can destroy the circulation and prevent further bleeding.

The Use of the Pulmotor

Fig. 8 shows an attendant using a pulmotor on an asphyxiated man. He has set him down sitting with his legs straight out before him. A rolled coat is laid on the ground a little below where his shoulders would come when he is laid out at full length. The erect portion of his body is then laid back so that his head rests on the ground, and his back is curved over the coat. In this manner, by bending his body, his throat is made perfectly straight and in the best of shape for breathing, real or artificial.

The tongue is drawn out by a retractor, which is a pair of light nippers which can be set in place so that no extra pressure has to be placed on them except at the time of application. The retractor is passed into a gas-tight bag, which forms part of the pulmotor, and the tongue is held up by holding the retractor through the walls of the bag. The pulmotor, which, of course, is already being held over the face of the patient, is now pressed forcibly over the nose and mouth, and the valve of the pulmotor is opened. The apparatus then automatically drives oxygen into the lungs of the subject. As soon as his lungs are full, the pressure reverses the valves in the pulmotor, and then it exhausts the waste gases, or the unused oxygen, from the lungs of the subject.

National First Aid Meet

By R. Dawson Hall

On Tuesday, Oct. 31, the National Mine Safety and First-Aid meet was held in the Forbes field, Pittsburg. The demonstration was attended by some 20,000 people, including President Taft, Secretary Fisher, Miss Mabel Boardman, Governor John K. Tener and Major Lynch. The first part of the program was the work of the Red Cross teams, 40 in all competing. The uniform of the men and their general deportment elicited much praise. Seeing that these men have been drilled in disconnected centers and that the Red Cross Society has not been able to provide all the assistance which it would have preferred to bestow, the work has been phenomenal.

There is no question but what the time was ripe for the work when Doctor Shields first took hold of it, and when the efficient organization of the Red Cross took it up. The 10 events were well performed. The enthusiasm of those who took part was unquestioned.

It is permissible, however, to criticize some few things, one especially which the teams have been urged continually to avoid. Respiration should never be restored by the Sylvester method when a man has badly burned or fractured arms. It is pathetic to watch some of the teams working badly wounded arms up and down in this sort of calisthenic exercise. Nor should the subject be allowed to put his mouth down on the ground when other forms of respiration are used. Just think what such a treatment might mean to a subject who really had such wounds, or had ceased to respire.

It is wrong to excuse a team by saying it is rattled. The men should never get confused, for a mine disaster develops the disease and only cool men should be chosen for first-aid work. The appearance of the men would be greatly improved if all, instead of about 90 per cent., were taught to deport themselves like soldiers, when not attending subjects. I would also suggest that all patients be placed in similar positions on the mats.

It seems, however, an ill acknowledgment of such excellent work to criticize what few things were wrongly performed. Still more unenviable would it be to pick out among so many excellent teams, one of superlative merit; the work was not to put the burden of choice on anyone else.

An account of the Bureau of Mines demonstration, which followed, must be omitted and left for another issue.

Explosions in Great Britain

The following is a list of the colliery explosions in Great Britain, with the date of occurrence and the number killed, that have occurred since 1851, involving the loss of 100 lives and over:

RECORD OF ENGLISH EXPLOSIONS

Mine and Situation	Date of Explosion	No. Killed
Cymmer, Glam.	July 15, 1856	114
Lund Hill, Yorks.	Feb. 19, 1857	189
Risca, Monmouth.	Dec. 1, 1860	142
Oaks, Yorks	Dec. 12, 1866	361
Ferndale, Glam	Nov. 8, 1867	178
Swaithe Main, Yorks.	Dec. 6, 1875	143
Blantyre, Lanarks	Oct. 22, 1877	207
Haywood Wood, Lanarks	June 7, 1878	189
Risca, Monmouth.	July 15, 1880	268
Abercarne, Monmouth.	Sept. 11, 1878	120
Seaham, Durham.	Sept. 8, 1880	164
Naval Steam, Glam	Dec. 10, 1880	101
Clifton Hall, Lancs	June 18, 1885	178
Llanerch, Monmouth.	Feb. 6, 1890	176
Park Slip, Glam.	Aug. 26, 1892	112
Combs Pit, Yorks	July 4, 1893	139
Albion, Glam	June 23, 1894	290
National, Glam	July 11, 1905	119
West Stanley, Durham	Feb. 17, 1909	167
Whitehaven, Cumberland	May 11, 1910	136
Pretoria, Lancs.	Dec. 21, 1910	344

Thus, of 21 explosions in which 100 or more were killed, three occurred in February with 532 deaths; one in May with 136 deaths, three in June with 657 deaths; four in July with 492 deaths; one in August with 112 deaths; two in September with 432 deaths; one in October with 207 deaths; one in November with 178 deaths; five in December with 1091 deaths.

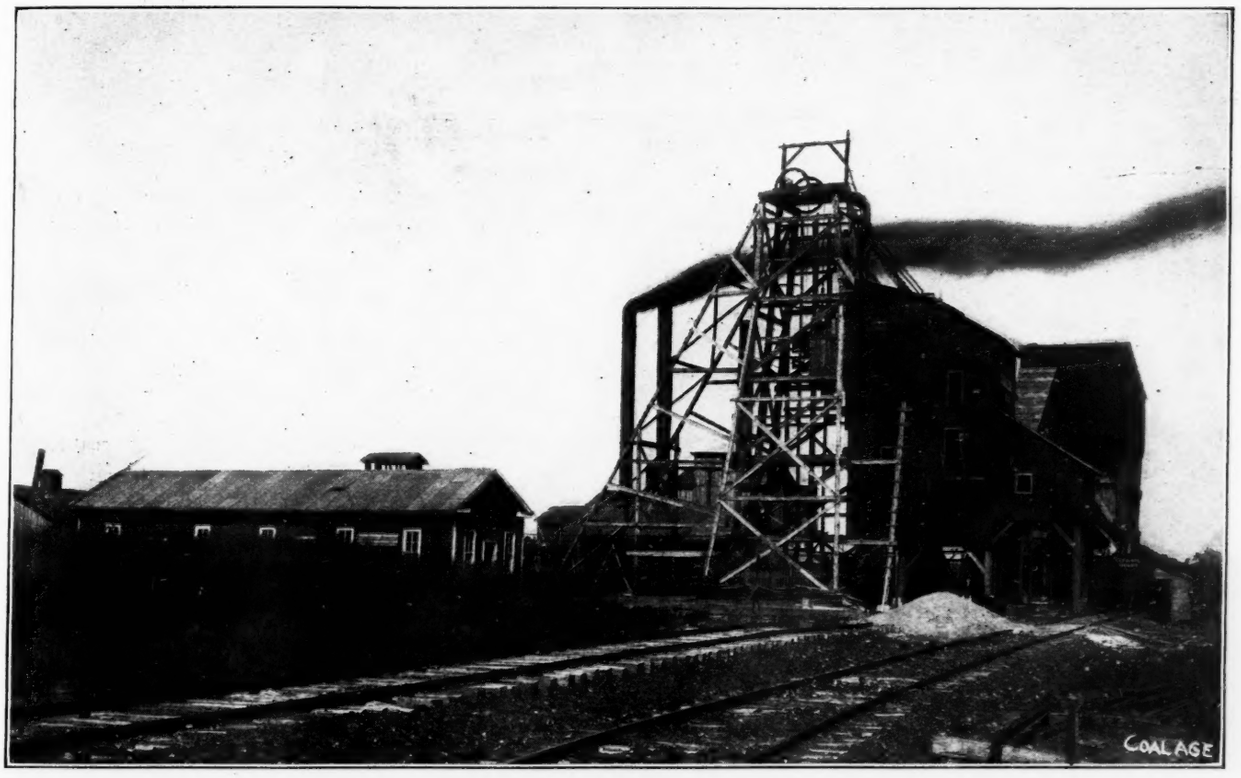
Explosion in Illinois Mine

By Floyd W. Parsons

It appears that the explosion in O'Gara mine No. 9 at Harrisburg, Ill., was caused by the ignition of a keg of blasting powder. A fortunate circumstance prevented a much higher death roll.

The most serious mine accident that ever occurred in Saline county, Illinois, took place Monday morning, Oct. 23, in O'Gara mine No. 9, at Harrisburg. Eight American miners were killed.

Immediately after the explosion, rescue parties were formed and made their way into the mine in an effort to save the men who were entombed. The rescuers were directed by Superintendent Morris, of the O'Gara Coal Company. Assisting Mr. Morris were William Johnson, general superintendent, and George Morris, assistant superintendent, of the Saline County Coal Company. After encountering serious difficulties incidental to the noxious fumes that followed the explosion, the rescuers succeeded in reaching the scene of the disaster and, by effective working, brought out a dozen men who were overcome by the gases.



O'Gara Coal Company's No. 9 Mine Where Eight Men Were Killed

After getting the affected miners to the surface, where they were placed under the care of doctors, the rescue party returned to the workings and continued their efforts until they reached the North entry where they found the bodies of 8 men who had succumbed to the effects of the gases following the explosion.

The dead were all found in rooms 14, 15 and 16, in the main North entry. None of the victims were disfigured, or seriously burned, but all were found with their faces covered—some with their hands and others having parts of their clothing drawn over their faces in a vain effort to keep out the poisonous gases. Several members of the rescue party were temporarily overcome by the gases, but were revived later.

About an Hour Elapsed

It was fully an hour after the explosion occurred before the rescuers got into the rooms where the bodies were found. The victims were immediately carried to the shaft bottom, and a little later taken to the surface where a temporary morgue was made available.

It is fortunate that only about 25 men were in that part of the mine where the accident occurred, and, aside from the 8 miners who lost their lives, the others either made their way out or were carried to the surface by the rescuers. It is reported that about 400 men were at work in other parts of the mine and were not affected by the explosion or the gases that followed.

Probable Cause

As is usual after a serious accident of this kind, a number of theories were advanced as to the cause of the explosion. The firebosses who examined the mine on the morning of the accident reported the workings free from gas. The company officials claim that the mine is not gaseous and has never been reported as dangerous. The workings are naturally damp so that no great attention was paid to moistening the dust. The seam that is worked averages over 6 ft. in thickness and lies 168 ft. from the surface.

The investigations seem to indicate that the explosion was caused by a keg of blasting powder which was accidentally set off. This theory is borne out by the statements of the rescuers who claim that when they entered the mine and ap-

proached the affected district, the powder fumes were so heavy that they had great difficulty in penetrating to the point of origin. If the explosion had been gas or dust this condition would hardly have been present.

A Fortunate Circumstance

In connection with this accident, it seems to me that fatalities would have been considerably heavier if the fumes of the powder that exploded had not been drawn into the adjacent mine, O'Gara No. 4, which was temporarily idle. The circumstances were as follows: The main North entry, just off which the explosion is thought to have occurred (in room 15), has an underground connection with mine No. 4. This latter mine was being ventilated by an exhaust fan although no men were at work underground. The force of the explosion blew out the stopping that connected the North main in mine No. 9 with the workings of No. 4, short-circuiting the air and causing the fumes and gases to be drawn out through No. 4 mine. The ventilator at No. 9 mine was working as a blower while No. 4 fan, as before stated, was exhausting.

It is quite probable, if the door connecting the two mines had not been blown down, the gases of the explosion would have been forced back through No. 9 mine, suffocating more men.

State Mine Inspector Rosbottom brought out the twisted and misshapen powder keg that is alleged to have been the cause of the disaster. This keg will be presented as evidence at the coroner's inquest. A few investigators have advanced the belief that the explosion was due to gas from mine No. 4 entering mine No. 9; however, there appear to be no facts to support this belief. The contention of the O'Gara people is that a lighted lamp was left near the keg of powder and in some manner fire from the lamp reached the powder, causing it to explode.

Considerable secrecy has been maintained by the O'Gara company in connection with this accident. No first-hand analysis of the explosion is possible, therefore, at the present time. COAL AGE will publish the final verdict when the facts are made public.

Explosion Test at Bruceton Mine

By J. T. Beard

After some delay the mine was fired by an explosion of coal dust resulting from blownout shots.

The National Mine Safety Demonstration inaugurated and carried to a successful culmination under the auspices of the United States Bureau of Mines, American National Red Cross and the Pittsburg Coal Operators' Association, this week at Pittsburg, reflects great credit on the promulgators of the movement. The results proved that the effort was appreciated by the great body of mining interests in this country. No larger or more representative gathering of mining men has ever been called together than that which assembled at Pittsburg, Monday and Tuesday, Oct. 30 and 31, to witness and take part in this first great national demonstration.

The readers of COAL AGE are already familiar with the large amount of preliminary work that was required and has been so wisely executed during the past two years following the terrible mine disasters of 1906 in France, Japan and especially in West Virginia. There was need of wise enactment of law that could only be accomplished by the united efforts and action of the various mining interests represented in the large engineering and mining societies, institutes and congresses of the country. Suffice it to say this preliminary work has been done wisely and today the Federal Bureau of Mines is the child of these coöperative interests, born in the hour of necessity and now rapidly attaining its majority and proving its worth by its wisdom and activity. In spite of some little adverse criticism coming naturally as the result of the division of work that must always follow the inauguration of any new department or bureau in either national or State governments, the Bureau of Mines has quietly performed its work and is rapidly gaining the confidence and cooperation of all classes of mining men and mining interests from the engineer and operator to the miner. COAL AGE does not hesitate to earnestly commend the work of the bureau to its many readers and asks of them the most hearty cooperation and support, which we feel is already being cordially given.

One of the main features of the present demonstration was a dust explosion in the experimental mine now leased by the Federal Bureau of Mines from the Pittsburg Coal Company for the purpose of making its investigations of mine conditions more real, and for keeping in touch with actual practice. This mine is located at Bruceton, about 13 miles from Pittsburg. Before the Government could enter into or become a party to this contract or lease, it was necessary for Congress to pass an enactment with the approval of the Secretary of the Interior, which was done shortly after the creation of the Federal Bureau of Mines. The act of Congress, we understand, carried an appropriation of $450,000, which was thus placed at the command of the newly created bureau, for its allotment to the various branches of the work now in its charge. Through this allotment by the Bureau of Mines, we believe a fund of $65,000 became available for the equipment and work of the experimental mine at Bruceton.

Availing itself of the generous offer and the hearty coöperation of the Pittsburg Coal Company, the Mining Bureau was not slow to contract for the lease for one year of the tract of coal at Bruceton where the present experimental mine was opened about August, or September, 1910. The Government cannot enter a contract for a period of time greater than one year; but the Bureau of Mines, we understand, has been assured verbally of the willingness of the Pittsburg Coal Company to extend its lease of the mine at the expiration of the time named, should an extension be desired by the bureau.

By the terms of the agreement, the mine was opened according to plans approved by the Pittsburg Coal Company. This was necessary in order that the coal company might operate the mine for its own purposes at any later time when the bureau might wish to abandon its investigations along this line. During the period of practically twelve months in which the bureau has been pushing its work of investigation at Bruceton, the mine has been opened, the necessary surface buildings erected, much concrete masonry put in at the drift mouth and in portions of the mine entries where it was necessary to establish recording stations for holding the various instruments used to indictate the pressures, velocities, temperatures, etc., resulting from a mine explosion. In this period of twelve months the main entry and air course have been driven practically 750 ft. into the hill.

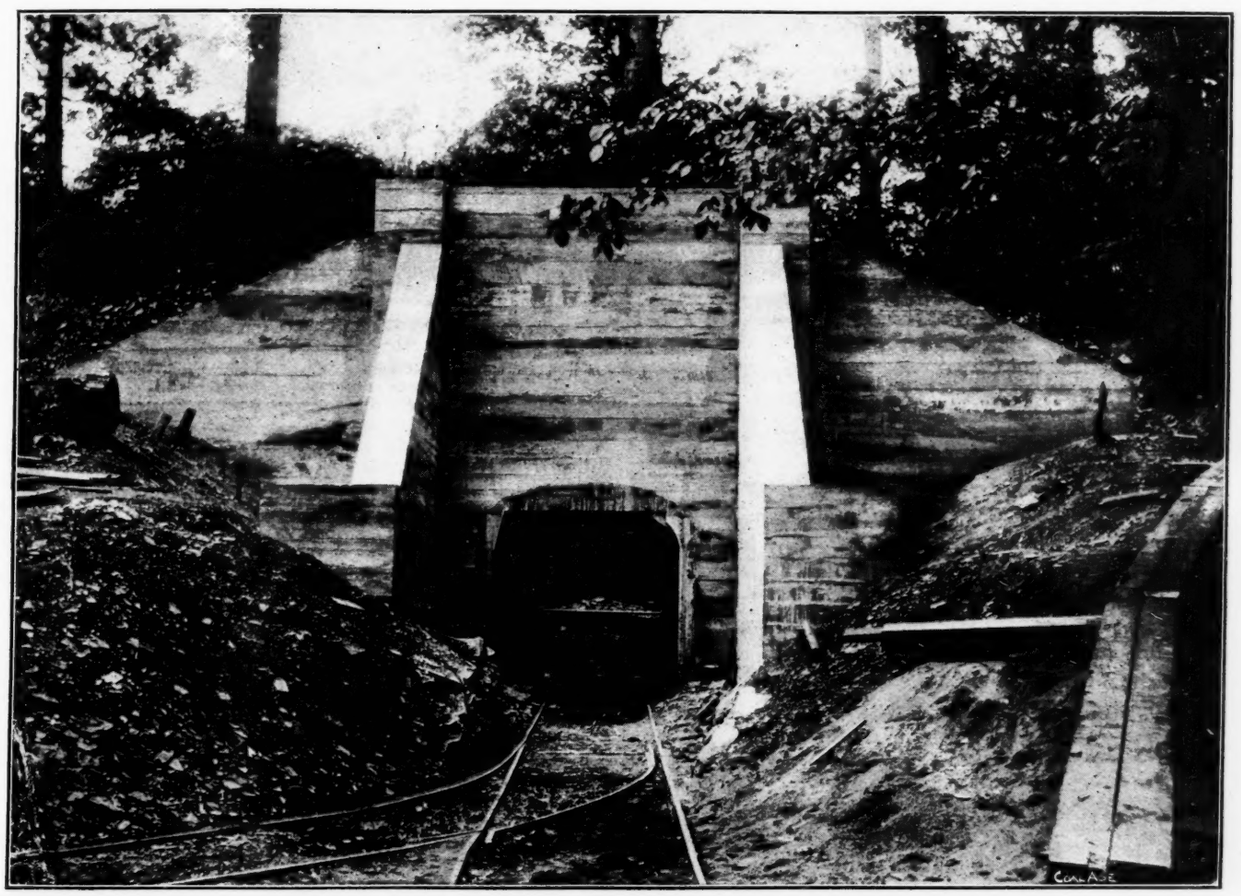
Ventilation of the Mine

Ventilation was at first secured by the erection of a small Sirocco fan, 36 in. in diameter and 20 in. wide, at a point near the mouth of the drift air-course. This fan furnished an air-current of about 4000 cu.ft. per minute; its position, however, was later changed to better suit the purpose of the tests, to its present position in the mouth of the steel tubes or second opening. In this latter position, the fan is run as a blower. The air-current is taken in through the steel tubes

and conducted to the last crosscut between the drift entry and air course, about 60 ft. from the face of these entries.

Location of Shots to Explode Mine

It was in the face of this drift heading that the shots were located, which were, by their explosion, to fire the dust that was scattered on shelves arranged along the ribs the entire length of the entry or drift. These holes were bored straight into the face of the solid coal, from 3 to 4 ft. in depth. Each hole had a diameter sufficient to contain a piece of 1½-in. iron pipe, which was closed at one end with a wooden plug and filled with about 2 lb. of black blasting powder and inserted into the hole bored in the coal after which the hole was tamped with 6 in. of clay. An electric fuse was used to fire the charge.



The Main or Right Portal of Government Experimental Mine, Bruceton, Penn.

The Purpose of the Experiment

The purpose of this experiment was to prove or disprove the theory that simple coal dust in a finely divided state would explode under certain favorable conditions without any gas being present. The mine at Bruceton was entirely free from gas, none having been found in the frequent careful tests that were made to discover gas. The mine was therefore well adapted for the purpose in view. In order to insure the success of the demonstration that took place Oct. 30, a trial explosion was arranged for Tuesday, Oct. 24. The results of this trial exceeded all the expectations of those in charge and served as a guide for future experiments. The roar of the explosion and the accompanying blast of flame issuing from the mine openings was described by those who witnessed the experiment as terrific. After this trial the mine was again put in order and prepared for the later demonstration.

A Dust Explosion Demonstrated

Little, if any, change was made in the amount of dust used and the charge of powder required to produce its explosion; these amounts had been well calculated in the first trial experiment. About ½ ton of dust was used in the entire length of entries, or an average of 1 lb. of dust per lineal foot of entry in the main drift, and ½ lb. per lineal foot in a portion of the intake airway. This dust is to be prepared at the mine by crushing and grinding the coal and passing the same through a 100-mesh screen. The result is a fine impalpable powder that is readily blown from the shelves on which it is placed, by the force of the blast.

Inspection of the Mine

Previous to the explosion the visitors were allowed to pass through the mine, entering at the drift mouth and passing in through the main heading, which was the return airway, to the face and then out along the intake airway and through the steel tube to the surface. It is estimated that 1231 persons entered and inspected the interior of the mine.

It had been expected that only those directly interested in and acquainted with mines would go underground, but in compliance with the popular desire to see all there was to be seen, no one was denied entrance. This inspection of the workings exhausted much valuable time and it was long after the time set for the explosion when the first attempt was made to fire the mine.

Preparing for the Blast

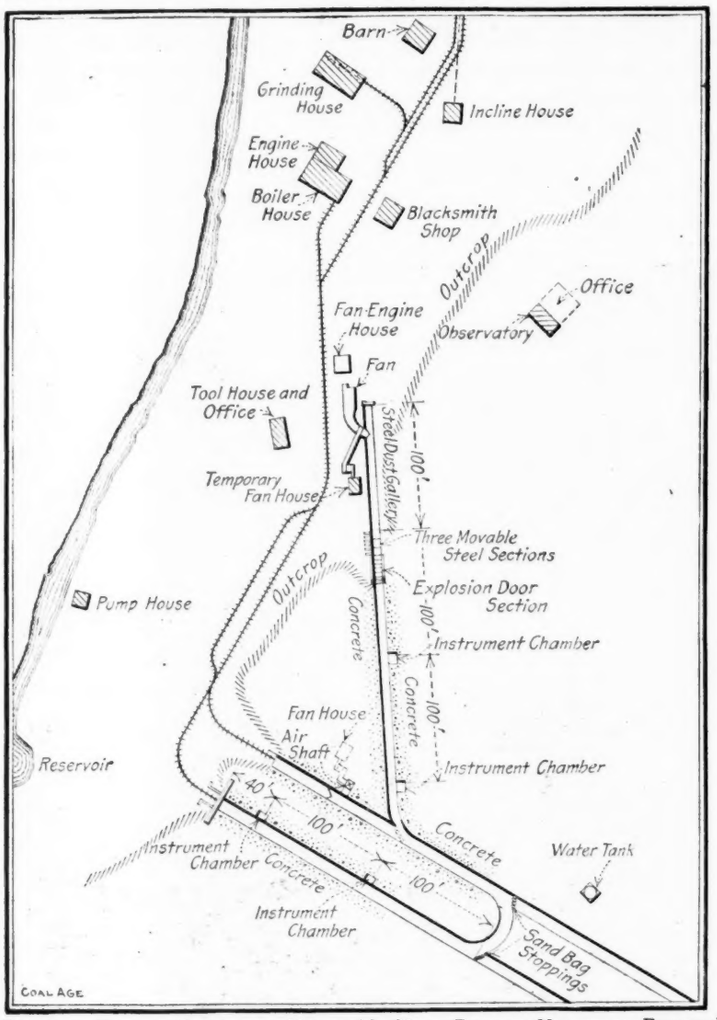
After everyone had returned to the surface and before the blast could be fired, it was necessary to remove the line of incandescent lamps that were used to light the entries, and to make the electric connections at the face of the heading. When this was done, the first attempt was made to explode the mine, shortly before 5 o'clock. Three pistol shots were fired, announcing that all was

in readiness and that the explosion would soon take place. A small six- or eight-volt blasting battery was used, but the blast failed to explode. The officials in charge were wholly at a loss to understand the reason for the failure. No time was to be lost, however, and after a hurried consultation, the wires were disconnected and men sent into the mine to ascertain the cause, and, if possible, remedy the trouble.

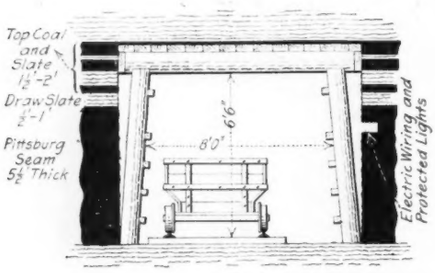
The Second Attempt Failed

A half-hour later, three pistol shots told the waiting throng that all was ready for a second trial. The expectancy of the next few moments can better be imagined than described. The gathering darkness and the drizzling rain, which had been falling during the afternoon, added much to the unpleasantness and the vexation caused when this second attempt to explode the mine failed.

It was now 5:30 p.m.; the squad of rescue men who had been anxiously waiting for over two hours to take their part in the demonstration and enter the mine immediately after the explosion, were now sent back to their car. Many others gave up in despair and returned to the station, believing there would be no further attempt made by the officials to carry out the program. A large number of the waiting throng, however, still remained, possessed with what seemed to be a forlorn hope that they would yet experience the reward of their patience and witness the longed-for explosion at the mine. In the meantime, the determination of the officials grew with the fast-coming darkness. A new line of wire was run into the mine and connection made with the lead wires of the fuse at the head of the entries. When this was done the full voltage of the electric-light circuit (110 volts) was turned on.



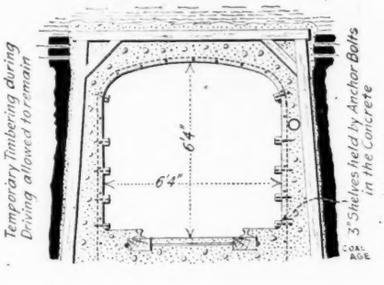
Official Map of Bruceton Mine. (A More Recent Map is to Follow)



Timbered Mine Entry

Reinforcing Arches ½" ø 32" C. to C.
8'0"
7'6"
Longitudinal Reinforcement ¼" Round Bars 12" Apart
Box and Pipe for Wiring and Lights
Ditch

Concrete Mine Gallery



Timbered Entry Concreted

Cross-sections at the Government Mine, Bruceton, Penn.

The Explosion

The effect was magical. The air was suddenly rent with a thunderous roar and the heavens illuminated with a fiery glare that for a few moments sent terror to the hearts of those still waiting on the hillside. Practically simultaneously with the roar underground there was a burst of flame, first from the main-drift mouth and a second later from the steel tube at the second opening. This was accompanied with the sharp rattle of the manhole doors of the steel tube as they were successively blown open by the force of the blast, the sound much resembling the roll of a drum.

The scene, with its surroundings of tall forest trees, the deep ravine and the hillside, was spectacular in the extreme. The flame bursting from the mouth of the two openings of the mine spread sidewise about 50 ft. on each side of the opening and reached an estimated hight of 100 ft. in the air, rolling backward from the tunnels in such volume and fury as to thoroughly alarm the crowd of spectators on the hillside above. These observers fled precipitately in all directions. The explosion lasted but a few seconds, however, and all was again wrapped in darkness now blacker than before, owing to the dense volumes of smoke that poured from the mine openings. The flame in many places had

ignited dead leaves of the tall trees, which, but for their wet condition, might have caused a more serious conflagration. The air for a brief period of time was filled with falling débris, soot and burning leaves. A mine car containing some 500 lb. of gravel, standing about 40 ft. in front of and in line with the mine drift, was blown nearly 200 ft. across the ravine, while another car loaded with rock was moved some 20 ft. and turned partly around. The event was certainly an important object lesson that cannot but prove of lasting benefit to all who were privileged to witness the scene. The Bureau of Mines is to be congratulated on the result of this part of the first national safety exhibit.

Motors Shielded Against Gas

Legal rules in some countries require that electric motors installed in gaseous mines shall be constructed or mounted so that the sparks which they may produce will not cause explosion.

A requirement that the construction of the motor shall afford protection against gas does not mean that it shall prevent

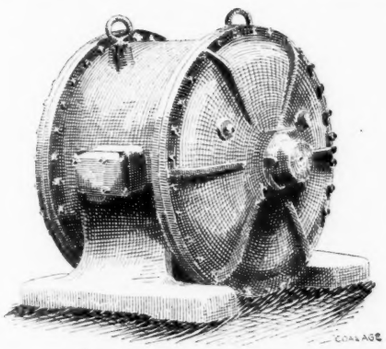


FIG. 1. ARMORED MOTOR

ignition of such gas as may be inside the motor, for that would be a condition impossible to satisfy. Although the motor be completely inclosed, the shaft emerges from the frame, and consequently it is impossible absolutely to prevent gas from penetrating to the interior. The real requirement, therefore, is that in case an explosion occurs inside, it shall not be propagated to the outside.

As regards the protection of motors against gas, great importance may be attached to the experiments which took place from 1903 to 1905 in the mines of Gelsenkirchen under the auspices of the Association of Mining Interests of the district of Dortmund, Germany, at the expense of the mining fund of Westphalia in coöperation with various manufacturing companies, and under the direction of the assessor of mines, Mr. Beyling. These experiments showed that there existed two methods of constructing motors guarded against gas. These two methods have been employed with success.

THE TWO METHODS

The first method consists in completely armoring the motor and constructing it so solidly that it will resist the pressure in case an explosion occurs inside of it. Fig. 1 represents a motor of this sort completely armored.

The second method is to let the gases of the explosion issue, but so to cool them that they cannot carry the fire to the surrounding atmosphere. For this purpose is provided a casing for the motor with protecting rings composed of numerous annular pieces of sheet metal placed about half a millimeter apart. The explosion gases pass radially through the rings and are so cooled by the surfaces of the plates, that it is impossible for them to communicate the fire to the surrounding atmosphere. The effect is analogous to that of the wire gauze in the Davy safety lamp.

The frame with its rings and sheet-metal sheathing entirely surrounds either the whole motor, Fig. 2, or only those parts where sparks may be produced during service. In the latter case, where half armored or open motors are used, the

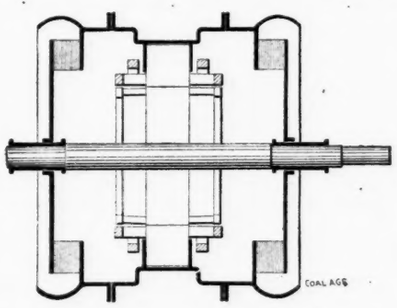


FIG. 2. GAS COOLING CASE

air and gases can freely circulate. Simply the collector rings or commutators are inclosed in a box with a protective ring.

As has been shown by the experiments above mentioned, the safety rings ought to be constructed with great care, since if the uncooled gas escapes at but a single point, the safety arrangement will prove unavailing. The same danger would exist where there was some grounding in the frame of the motor.

It is highly important that motors intended for gassy mines shall, before delivery, be tested most carefully under all the conditions to which they will be subjected after installation.

Be careful not to oppose respiration on the part of an asphyxiated person about to recover under treatment. Do not compress his lungs when he desires to inflate them. If the respirations are long apart, carefully continue the bellows-blowing action between natural respirations.

First Aid in Accidents

The following is a timely excerpt from the circular No. 110, on, "First Aid to the Injured," issued by Johnson & Johnson:

The greatest danger to wounds from accidents is due to contamination with foreign substances, not always visible, but far reaching in effect. Certain invisible irritating matter (germs) quickly find lodgment in any wound by transference from the air, the clothing, the skin; in fact, from anything that may come in contact with it. In consequence of such contamination, blood poisoning, gangrene, inflammation, fever, erysipelas and a train of complications are liable to follow any wound.

Small scratches and pricks, when not properly cared for, may result in inflammation and the formation of gatherings or abscesses, which will disable a person for a considerable time or cause the loss of a limb or even endanger life itself.

The necessity and value of prompt and efficient first aid in injuries needs no comment. During the war with Spain, in the Philippine campaigns and in the Russian-Japanese war it has been established that, by the prompt application of first-aid dressings, the loss of life and limb has been reduced to the lowest ratio in the whole history of warfare.

The modern practice of surgery requires that the dressings applied to a wound shall not only look clean, but shall be surgically clean (that is, aseptic), free from surgical dirt.

The application of the principles involved, has saved many an idle day, soothed untold suffering and even saved millions of lives. From the surgeon's standpoint, a piece of spotless linen may be a filthy rag; he does not judge from the looks but by his knowledge of the effects.

Watering Dusty Entries

A recent English invention for watering dusty roads in coal mines is described as follows: A tub or tank is mounted on an ordinary mine-car frame in such a way as to leave, below the tank and above the frame, an open space, in which revolves an iron saucer-shaped disk with four vanes across its face. This disk or turbine rotates rapidly in a horizontal plane through the action of an endless chain driven by the wheels of the mine car. Water flows through a valve in the bottom of the tank, onto the turbine wheel below, and by its rotation is spread outward and upward, the flow being regulated by the valve. This latter may be of either the lever or screw type, the former permitting more rapid adjustment. The turbine wheel may be thrown out of gear at will by a lever which is controlled by the man in charge.

NOTE—From *L'Echo des Mines et de la Metallurgie*, Paris.

COLLIERY NOTES and COMMENTS

Practical Hints Gathered Here and There, and Condensed to Suit the Busy Reader

A miner recently lost his life from suffocation by natural gases. He went past a fence and past a danger sign into a drift, which he knew contained inflammable gas, in order to obtain a shovel which had been left in the drift several days before. The lesson is clear.

Remember that a little dirt adhering to electric mine machinery, a loose terminal wire, a poorly covered joint or careless cable insulation has often caused, and may at any moment cause, death. Careful investigations have shown that most mine accidents, due to electricity, are the result of want of care.

When the different coal-mining States demand an oral and written examination of all mine foremen, and issue certificates to the same before they are allowed to hold positions, and when the State delegates certain police powers to men who successfully pass such examinations, then and not until then will the mine laws be enforced, the death rate materially reduced and property conserved.

According to official reports more than half of the deaths due to the underground accidents in the Nottingham section of England are caused by falling roof; and this after every effort has been made to secure systematic timbering. The various causes of fatalities in coal mines are stated to be in about the following percentages: Falls of roof, 57.8; haulage, 22.6; shafts, 8.8; other causes, 10.8.

When about to institute first-aid instruction work in a colliery, let the first class consist of the bosses, superintendents and the heads of departments; then form classes among the miners. In this way all classes of employees will come in touch with the work, and in case of serious accident there will be a better understanding and more cordial coöperation among such men as may happen to be in the mine at the time the accident occurs.

A competent impartial State Mining Board, free from politics and composed of the most competent of specialists, would do much to prevent accidents, save life and conserve natural resources. To such a board the law should compel all companies to submit their plans as to surface buildings, underground workings, methods of mining and plan of ventilation before mining operations could begin. Such a board should be invested with the power to reject or approve plans submitted to them; thus only such plans as meet the approval of the highest mining authorities of the State could be adopted.

One English writer, in explaining what action should be taken after an explosion occurs, advised among other things that the manager place a notice board in a conspicuous position near the top of the shaft with the following cautions: "Real courage does not consist of being careless of danger, but of being quick to face and disarm it." "Courage without caution is dangerous; caution without courage is contemptible." Would it not be worth while to place such a cautionary signboard in some prominent position near the shaft at once without waiting for an accident to occur. Hundreds of miners have been killed through exercising courage without caution.

It has been demonstrated that sparks will pass between carbon dust, immersed in oil, under pressure of 50 volts, proving that in electrical pressure between metal terminals, the carbon dust which collects forms chains, so that the electricity passes easily from the one to the other. Where metal terminals are exposed, dust held in suspension is gradually deposited, and will be sufficient to establish a short circuit. Assuming a short circuit caused by coal dust at the terminals, and a cloud of dust caused by a traveling trip of cars, Professor Thornton, an electrical expert, concludes it will probably be sufficient to start firing along the roof and perhaps cause an explosion.

The inquiry into the disaster at the Maypole colliery in Lancashire, England, disclosed an apparent lack of any definite line of action to be followed by the firemen and shot lighters when they found parts of the mine dangerously affected by emissions of firedamp, a condition that must arise from time to time in gassy mines, however skilfully the ventilation may be applied. For this reason the commissioners concluded: "An important lesson to be learned from the disaster seems to us to be that an endeavor should be made in mines which make firedamp freely, to fix, if practicable, some standard of ventilation, with the object of lessening both the responsibility and discretion of the under officials."

Mine accidents usually occur at the working faces, which are generally remote from the mine hospital. In such cases, to save time, it has been suggested that a stretcher be made at the face with materials usually found there, such as coats, overcoats or a pair of grain bags, which are commonly used by miners to carry explosives into the mine, and a pair of rails, drills or pipes about 6 ft. long. In case the coats are available, they should be buttoned then turned inside out. Insert the rails or drills lengthwise into the sleeves, thus forming a comfortable stretcher. In case grain bags are used, both corners of the bottom should be cut off so as to permit the improvised handles to pass through. The bags placed lengthwise will make a good stretcher.

In organizing the rescue station at the Kleophas mine, in Upper Silesia, the management has arranged that, both night and day, six fully qualified men are always at the surface, and ready for immediate action. Of the three parties of six men each, the first is employed on the day shift on the surface, the second on the day shift in the mine, and the third on the night shift on the surface. The parties regularly change shifts and work both on the surface and underground. In this way they do not lose their knowledge of underground work. For rescue work to be most effective, there should always be a corps "ready at call" on the surface. This arrangement of shifts should be observed by all. If all the men were below they would be helpless in case of disaster.

At the conclusion of the inquiry into the Whitehaven explosion (Cumberland, Eng.), the jury recommended: "That the finding of gas in working places should be more generally noted and reported in writing; that the ventilation be more adequate; that a system of watering the main roads by means of a spray be brought into operation; that a special rule be made providing that no lighted lamp should be placed on the ground of the working place while the mining of coal is being proceeded with; that workmen on being given their working lamps should be supplied with a tally having numbers corresponding with those of the lamps; that the doors of the return airways should have special keys provided for the opening of the doors on the return side of the airway; that special attention should be given to training in ambulance work and necessary appliances; that strict observance of the special rules should be enforced on all workmen and officials."

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This journal is interested solely in matters relating to the fuel industries, and is designed to be a medium for the free interchange of ideas, the detailed description of coal-mining practice, and the expression of independent thought calculated to benefit both operator and miner.

Contents

	PAGE
Foreword.	101
Work and Purpose of Mining Bureau.	102
American Mining Congress Meeting.	109
National Mine Safety Demonstration.	110
Methods of Testing Explosives.	114
Illustrations of First Aid Work *M. J. Shields*	120
National First-Aid Meet. *R. Dawson Hall*	122
Explosions in Great Britain.	122
Explosion in Illinois Mine. *Floyd W. Parsons*	123
Explosion Test at Bruceton Mine. *J. T. Beard*	124
Motors Shielded Against Gas.	127
Watering Dusty Entries.	127
Colliery Notes.	128
Editorials:	
The Pittsburg Arsenal.	129
The Laws of Safety.	129
The Scranton Mine Cave Commission.	130
The Value of Scrap.	130
Examination Questions and Answers.	131
Coal and Coke News.	132
Coal Trade Reviews.	134

COAL AGE

The Pittsburg Arsenal

It appears a fitting time, now that so many mining men are gathered at the National Mine Safety Demonstration, to call attention to the undesirable quarters in which the Bureau of Mines performs its valuable work, and to express the fear that the significance of the bureau may be lost sight of by ourselves and our foreign visitors when we and they view the bare and meager buildings with which the operations of the bureau are surrounded.

Compared with our university and college buildings, with the offices of our larger corporations, with, one might add, the high-school buildings of our larger towns, the arsenal at Pittsburg, the home of our Bureau of Mines, looks squalid and commonplace.

There are questioners who wonder whether our universities and colleges, which teach the civil, mining and mechanical arts, do well to surround themselves with so much grandeur, training the young man to associate his profession with a luxury, with which in practice he must almost invariably dispense. This contrast results in his disillusionment and renders him, in a degree, at least, unfit for the vicissitudes of life he must later experience. But while this argument has a certain degree of truth for the raw product passing the collegiate mill, it cannot have for the finished product, mellowed by practical training and experienced hardship, such as finds home for research in the Bureau of Mines.

Uninviting indeed are the gloomy buildings offered as laboratories and offices to these engineers whose salaries are not so large as will compensate them for the inconveniences they must endure. Will an uninviting home for the bureau on an inferior street in an unfrequented part of the city, away from library and technical school, do the work that would be done, and enlist the men who would be enlisted if the investigations were carried on amid pleasanter surroundings?

It is true the lines of endeavor of the earnest men of the bureau are laid toward the accomplishment of more and more research in return for the penurious gifts of a nation, which is but tardily responsive to the needs of the work and the excellence of the results already obtained. Other bureaus, which have deserved no more from the public, have had magnificently appointed headquarters constructed for them. The nation should do no less for the Bureau of Mines, constructing a wing or central building for immediate needs only, and paying attention to the architectural possibilities of future additions. The plant should be located where it will be an adornment to Pittsburg, and a complement to its present dedications to knowledge, visible to the general public and ready of access to the valuable technical library stored within the walls of the Carnegie Institute.

The Laws of Safety

The codes of mining laws are the monuments of our care for life. Some are defective; some are reasonably well alined with our present knowledge; what they are, what they are not, is due to the operator and the miner in all States where mining is an important industry. True it is that both parties attack certain provisions as too onerous to one class or another, but if the proposed enactment is well grounded, the sentiment of the unprotesting carries the provision through. Although the general sentiment of the operators and miners is for safety, we sometimes feel abashed at the narrow arguments for laxity urged by the few. The impulse is well nigh universal that safety must ever hold first place.

This feeling was abundantly evidenced in the recent meet at Pittsburg. Operators and squads of men came from all over the United States to study safety and to exemplify it, willing to travel further to obtain such knowledge than they have so far shown themselves willing to travel for a broadening of their economic training. We cannot but feel proud that the knowledge which means money is less appreciated than the knowledge which means life.

The laws of each State are the laws framed by the mining industry. It made them, passed them and, as a whole, approves them, while they in turn approve the industry. These same laws have been created in accordance with the spirit of the age. The mining fraternity does not regard them as mere enactments, bristling with penalties, nor as disagreeable restraints, but rather as the outcome of the industry's better self. It is to be hoped ever that the law will be fulfilled, not in "the letter that killeth, but in the spirit that giveth life."

The Scranton Mine Cave Commission

There is a natural regret that the Scranton mine-cave commission and the engineers it engaged came to no startlingly new conclusions and gave no mollifying assurances to the public that security and absolute roof support could be obtained at small cost.

But it is no small misfortune when a city of 130,000 inhabitants, with buildings of great artistic merit (for indeed Scranton has some which for pure beauty are seldom excelled) rests upon a tottering series of crumbing walls, aggregating over 65 ft. in hight, and so arranged that the full strength of these is not obtained; walls that are yet to be removed wherever possible and for which no provision for replacement has been hitherto considered.

So sore an ill can be assuaged by no inexpensive cure-all. The city owes the commission a debt for bluntly acknowledging the magnitude of the peril and for urging on the citizens and operating companies that they provide adequate means, at the needful expense, for the prolongation of the life of the city they live in. It would have been criminal for the engineers hoping to mollify the public and the coal companies to have made an evasive or inadequate recommendation and a report filled with weakling deceits.

The hope of a gratifying report might have been held out, had the structure been in the form of a dome or an arch. Then the load could have been carried to certain limited areas, and fracture might have been prevented by provisions against excessive settlement at the inclosing walls or wall-like piers on which the dome or arch, respectively, rested. Or again, had the measures been, as they are in the case considered, relatively flat, and had, as is not the case, but one bed of coal been worked, then any attempt of the structure to fail as a beam, would have been prevented by the thrusts or horizontal pressures set up by the binding of the strata overlying the coal as they endeavored to crowd into the space between the supports. These thrusts, combined with downward loading, would create surfaces of pressure whereby the flat roof would be transformed into dynamic semblance to an arch or dome and the internal strains with resultant internal falls would probably create a real culvert or cupola with filled spandrels.

Such a roof might settle in one large area, as a vast unit, making the bulk of the city safe, even had the very supports of the arch been cautiously removed, providing care had been taken to secure the arch in position against side pressure, for though the thrusts in an arch, when it is high, are not considerable or large compared with the vertical loading, yet it is important that they be taken care of, for a structure of that kind, when it spreads at the supports is considerably weakened.

But with several beds worked and with intervals between the beds thin, the result can only be a series of superposed arches too shallow for self-sustenance, and for which there is no cure but filling, complete or incomplete. The method, proposed by the commission, is to provide a series of flushed foundations at the corners of city blocks, which will provide for the support of whole congeries of buildings, which, when shrinkage comes, will involve them altogether and let them down without mutual strain.

These blocks of buildings will have foundations spaced like those of the Eiffel tower and in a dynamic sense, will rest as if on a series of arches parabolically curved in three dimensions, as in that unique structure, yet with all the curves concave as viewed from below. The arches will be not the less truly entitled to that name, because they may happen not to be so shaped. They may continue to stand up like flat arches, such as are commonly used to span house openings, or they may break up and reshape themselves into the forms of quasi-Roman, or of quasi-ellipsoidal spans.

That it is better to support the street corners than the blocks themselves (unless indeed the filling is almost continuous) is seen when one reflects that one flushed pillar may shrink more than another and the strains resulting from the shrinkage would be likely to rend an overlying building, wall from wall.

The suggestion of filling the Dunmore beds is not unreasonable. It must be remembered that they are thin, none, over any large area, exceeding 4 ft., and a great deal of rock will need shooting in any event for gangways and chamberways, and where the roof is weak, there may be more roof fall than there is room adequate for stowage. The rock in the anthracite region is peculiar in that it stands air well and when piled in chocks, its first set under the final load is its last. There is no further settling as a result of its disintegration, or of the deterioration of the surfaces on which it rests.

The Value of Scrap

Many mine managers have the price of a coveted and necessary piece of equipment lying around their property in the form of scrap. The wornout car wheels and axles, gears, chain links and sprockets, old rails, old pipe, old rope and all the sundry discarded irons and castings which so generously bestrew the ground around some collieries, often represent a tidy sum of money.

Such accumulations of useless and discarded material are, moreover, apt to impart an appearance of disorder and an impression of waste quite out of proportion to the expense involved in systematically disposing of them. The stranger, be he merely an inquisitive visitor or the company's largest stockholder, judges, to a great extent, by externals. It is always well to avoid the appearance of evil. Scrap, left at random about a plant, has a decidedly negative value; it is worth a good deal to be rid of it.

It may be that the things which go to make up the colliery junk heap are looked upon by a wary and acquisitive foreman as possible saviors in some time of need, but any such expected value is seldom realized. When the emergency arises, it usually develops that nothing in all the varied assortment will quite fill the bill. Repair parts are one thing and scrap decidedly another. The former should be sound and serviceable, carefully stored and cared for. The latter is worth, perhaps, half a cent per pound.

EXAMINATION QUESTIONS and ANSWERS

To Encourage, Assist and Instruct Those Preparing for Firebosses, Mine Foremen, and Inspectors Examinations. Selected and Original Questions Are Carefully Answered And Fully Explained

Interesting Questions

To Prevent Accident, Loading Coal

Ques.—A large percentage of mine accidents is caused by miners persisting in loading coal where the roof is unsafe. What rule would you adopt to prevent this condition and reduce the number of accidents therefrom?

Ans.—An invariable rule should be adopted that no coal shall be loaded at the face until after the miner has carefully examined the roof and coal face, in his place, and either taken down or timbered securely all loose coal, slate or rock. This rule can generally be enforced by the penalty of a lost turn if the rule is violated. Every miner should be held responsible for the timbering of his own place; and the mine foreman and his assistants should see that such timbering is properly and promptly done.

Safety in Blasting in Mines

Ques.—Describe briefly the comparative merits of firing shots in mines by means of fuel, squibs and electricity, in respect to safety.

Ans.—When shots are fired by the common single-tape or double-tape fuse the length of the fuse can be regulated so as to give the person who fires the shot plenty of time to retire to a place of safety. This cannot be done in the use of squibs.

Indeed when squibs are used, the miner is often tempted to break off or shorten the end of the match of the squib, or untwist the end so as to hasten the explosion and at the same time to avoid the danger of misfire by the match going out after it has once been lighted. At times, the miner dips the match of the squib in coal oil for the same purpose. All of these practices are extremely dangerous, often causing the shot to explode before the miner has reached a place of safety. It frequently happens that, in the use of fuse for blasting, an unscrupulous miner, when he has overcharged a hole and is somewhat doubtful in regard to the safety of the shot, will cut a long length of fuse to enable himself to get well out of harm's way before the shot explodes. He does this, at times, with an entire disregard of the safety of his fellow workers. In the use of fuse a good quality of double-tape fuse should be employed. Single-tape fuse should never be used in mining, owing to the danger of the fuse being injured in the rough work attending the tamping of the hole, and in the rough handling which is general in mining work.

In the use of electricity for blasting there is always less danger of misfires, and the danger from hangfires is extremely slight, although both of these occur at times. There is, also, in the use of electricity, less danger of a premature blast, resulting in the miner being caught before he has reached a place of safety. In electrical firing, the battery should always be kept under lock and key and be in the charge of one competent person who is to fire the shot. The lead wires used to conduct the electric current into the chamber or room are never connected to the battery until all connections have been made at the working face where the shot is located. After the workmen have retired from the place the shotfirer brings out his battery and connects it with the lead wires; he then applies the handle and operates the battery. Should the shot fail to explode in this method of firing, after two or more trials, the shotfirer removes the handle from the battery, disconnects the wires and proceeds, after the space of a few minutes, to investigate the cause. In electric firing it is never safe to approach a shot that has missed fire before the elapse of from five to ten minutes, at least; and more than this time should be allowed if all possible danger from accident is to be avoided.

Hangfires in Blasting with Fuse

Ques.—Explain what conditions may cause a shot to hangfire where a fuse is used for blasting in mines.

Ans.—In firing blasts with fuse a shot may hang fire for an indefinite period, lasting from a few minutes to several hours, according to the kind and condition of the fuse in the hole. Perhaps the most common cause of a shot's hanging fire is due to a small piece of coal or rock being jammed into or against the fuse in tamping, whereby the train of powder is broken. The outer covering of the fuse then smolders till it at length reaches and ignites the powder beyond the break. Or the fuse may be damaged before it is placed in the hole, and give the same results as described above. Sometimes the powder of the fuse becomes damp and burns slowly and intermittently, or the fuse may be drawn out of the charge and only ignite the paper wad that some miners use over the powder; the paper smolders for a time and finally ignites the charge. In blasting with fuse, it is never safe to return to the face when a shot has failed to explode. The miner should go home and leave the investigation of the trouble for the next day. It is the only safe rule.

Safety Arrangements, Mule Haulage

Ques.—What arrangements should be made, in mule haulage, to insure the safety of drivers and all persons employed in the mine?

Ans.—Strict regulations should be enforced relating to the movement of cars, and especially providing for the meeting places of drivers on single-track roads. No cars must be left on haulage roads, or extending from the mouths of rooms where they would interfere with haulage on the main track, or in a position where they might become loose and run down grade. No car must be taken down a grade where sprags are required without the driver first seeing that such sprags are properly adjusted. A door must not be located at the foot of a sharp grade. Refuge holes must be provided at all doors for the protection of trappers, where trappers are employed; and at proper intervals on all haulage roads used as travelingways, except where such roads are wide enough to allow safe passage for men on the side of the track.

Safety Arrangements, Shafts and Slopes

Ques.—Mention briefly the various arrangements and appliances for safety, employed at shafts and slopes.

Ans.—The top of all shafts and steep slopes, as well as all landings, should be protected by suitable gates to prevent persons falling into the shaft or down the slope. Safety blocks should be placed on all tracks leading to the shaft or slope, on every landing, to prevent mine cars running or being pushed into the shaft or slope. All cages should be provided with sufficient hoods, safety catches and bridal chains; and where men are to be hoisted suitable guards should be used on each end of the cage. The last car of a trip being hauled up a slope of moderate inclination, should always be provided with a good drag-bar or "dog" to prevent any or all the cars running back down the slope, in case the rope or a coupling should break.

COAL and COKE NEWS

Editorial Correspondence from our own Representatives in Various Important Mining Centers, and a Record of Legislative and Other Action Affecting the Coal Industry

Washington, D. C.

Leasing System for the Alaskan Coal Lands

Secretary Fisher, of the Department of the Interior, has declared himself positively with reference to the policy he intends to recommend to Congress this winter in connection with coal mining in Alaska. Mr. Fisher's statement has been received with unusual interest in this city because of the influential character of his recommendations, particularly in view of his recent visit to Alaska. As already forecast, Mr. Fisher takes the view that the value of the Alaska coal has been greatly exaggerated. There are, he says, great quantities of lignite and low-grade bituminous coal in several parts of the Territory, but there are only two known fields of high-grade coal in Alaska, the Bering River field and the Matanuska field, both of which contain anthracite and high-grade bituminous coal.

"My own judgment," says Secretary Fisher, "is that the present market for Alaskan coal is limited and uncertain, but that the demand will rapidly increase as the country is developed." Whatever may be the value or extent of the demand, Mr. Fisher thinks that the time has past when public mineral lands should be allowed to go into private ownership in fee simple. He, therefore, urges the leasing system, saying, "Taking all our principal coal-mining States, the census figures for 1909 show that out of a total of 6,900,000 acres of coal lands under operation more than 2,000,000 acres, or 30 per cent. of the whole, were in 1909 operated under a system of private leases. It is, therefore, substantially correct to say that, whether we like it or not, the choice is not as to whether we shall mine our coal on the leasehold system, but whether we shall mine it under leases from private owners or from the Government direct."

Conditions and Terms of Leases

"That the customer has everything to gain under the Government leasehold must be apparent because the Government can make its royalties as little as it chooses and it has no invested capital and no unearned increment on which to pay returns. Opposition is to be expected only from those who wish to secure our coal lands for stock-jobbing or speculative purposes or so that they may make a greater profit than is essential to secure immediate development. Indeed, immediate development can be assured only under the leasehold system. Without it there is no reason why private individuals should not secure the property and hold it out of development until they can take advantage of the increasing demands of the future."

"Expedients could be adopted in the effort to enforce development by requiring the purchaser to mine a certain amount of coal or to expend a certain amount of money in developing the land under pain of forfeiting his title to the Government, but this, after all, is only a crude and awkward device for securing what can be far more effectually secured by means of a lease. Regulation of this sort would be a new departure in either State or Federal administration. It would raise fundamental questions of public policy about which differences of opinion exist, which are as yet uncompromising. It would doubtless prevent any early action by Congress."

"Under these conditions it would seem a sufficient undertaking to inaugurate a new system of tenure, without imposing upon Alaska the additional difficulties of the administration of a hitherto untried attempt to settle by public regulation what would constitute a reasonable profit for the miner, the wholesaler and the retailer of coal."

Rates on Coke to Chicago

An application has been filed with the Commerce Court by the Anaconda Copper Mining Company and the Boston & Montana Consolidated Copper and Silver Mining Company to review the decision of the Interstate Commerce Commission in the case involving the rates on coke from West Virginia and Pennsylvania to Chicago and Chicago junctions.

Previous to the present year the railroads had in effect a rate on coke of $2.65 for smelting and $2.35 for iron furnaces. The copper companies desired to collect reparation on shipments made under the $2.65 rate during five years, which, it is said, would have amounted to $18,286. The commission decided that the railroads should have but one rate on coke between these points, but refused to take any action relating to reparation. The single rate was to go into effect Dec. 31, 1910.

William A. Glasgow, Jr., representing the copper people, recently filed the petition with the court to review the decision of the commission and to award the complainants the reparation demanded.

Alabama

Birmingham—The Mulga mine, which is the property of the Birmingham Coal and Iron Company, is now one of the best equipped mines in the State. The daily output is averaging 1100 tons and the 400 men employed there are working full time.

In a report issued Oct. 28, the Alabama State mine inspector states that there are now 242 coal mines in the Birmingham district, of which number, 21 are idle at present. There are over 20,000 miners at work in this field and 6000 more could be employed under existing conditions, according to the report.

The Coosa Valley company has been organized at Atlanta, Ga., with a capital of $2,000,000, to develop coal and mineral lands in northern Alabama.

Colorado

Oak Creek—The Routt County bank of Oak Creek and the various business houses on a recent pay day cashed checks totaling $75,000. This is the largest amount paid out in any one month in the history of the Routt county coalfields, but it is said that each succeeding month will show still further increase.

Cañon City—The 150 miners of the Bear Gulch mine of the Colorado Fuel and Iron Company, went on strike recently, as a result of the inauguration of the basket scale in paying for the coal.

Pueblo—This city is very much incensed over a recent increase of 25c. per ton in the retail price of coal and the project of a municipally operated coal mine is being discussed.

Illinois

Duquoin—Despite the discouraging conditions which exist in the southern Illinois coalfields as a result of the railroad strike, unusual activity is being manifested by the coal interests in sinking new mines.

Several new shafts are now being sunk in Williamson and Perry counties. A company of Tamoroa business men has secured the Kimsey farm of several thousand acres, northeast of this city, and the work of sinking a large mine is under way.

The Zeigler District Coal Company of Chicago, which owns a large mine at Christopher, has purchased several thousand acres of untouched coal land near Mulkeytown, east of this city, and will sink a shaft.

Indiana

Indianapolis—President White, of the International Mine Workers' Union, has sustained the officials of the local unions in calling a special session of the organization to pass upon the weekly payday proposition. President White held that there was no evidence that the local officers acted hastily in calling the convention, and that the proceedings throughout were fair and legal. This means that the semi-monthly payday will stand until the present contract between the miners and operators expires next April.

Iowa

Newton—A 3-ft. vein of coal was discovered recently several miles south of here. It lies at a depth of 34 ft., under 17 ft. of rock.

Des Moines—Amended articles for the Lucas Coal and Supply Company, of Lucas, capital stock, $250,000, have been filed.

Kentucky

Middlesboro—The Interstate Coal Company has purchased 800 acres of coal land in Knox county for $50,000, and will develop mines.

Louisville—The Kentucky and Indiana Terminal railway has awarded a contract to the Roberts & Schaefer Company, Chicago, for a 500 tons capacity coaling station to be built at Louisville.

Montana

Havre—The Havre Electric Light Company is opening up a coal mine 3 miles north of town. The vein is 3 to 4 ft. thick, at a depth of 150 ft. and the coal is reported to be of excellent quality.

Ohio

Columbus—For some time past a syndicate which has acquired large areas of land in Richland and Jackson townships, Vinton county, has been exploring for coal and it is said that large areas have been found, among them a 53-in. vein. Practically every acre of land in the two townships is under either option or lease. The Columbus & Southern railway, it is said, has passed into the control of the same interests, and will be extended to give an outlet for the coal.

The consolidation of the big coal interests of eastern Ohio, which was reported some time ago as under way, has been practically completed, according to recent information. The combination will include the five largest operating companies in Jefferson, Belmont and Harrison counties, and will have a property valuation estimated at $20,000,000.

The new apparatus purchased by the State, recently was the means of saving from death eight men overcome by gas in the Black Top mine of the Morris Coal Company at Lore City, Guernsey county, according to report made to the State mine inspectors' office.

Pennsylvania

BITUMINOUS

Pittsburg—It is reported that a coal deal between local capitalists and a New York syndicate involving $1,000,000, has been closed. Several thousand acres of coal lands in Forward township, near Elizabeth, in the McKeesport district, are said to have been sold. According to the report, building of tipples and docks will be commenced at once.

The experimental mine of the U. S. Bureau of Mines, at Bruceton, Penn., was the scene of a coal-dust explosion Oct. 24. About 200 lb. of coal dust were purposely ignited by the engineers in charge and from all reports the results exceeded their expectations, considerable damage having been done.

Ohiopyle—It is stated that several mines will be opened up in this vicinity along the extension of the Western Maryland railroad. Recent investigations by this company are reported to have resulted in disclosing something like 10,000 acres of high-grade coal land.

Indiana—With five openings in active use and four more ready for work within a few weeks, the Penn Mary Coal Company, of Heilwood, expects to close the year with its finest record since the opening of the mines.

ANTHRACITE

Scranton—Reorganization and financing of the Peoples Coal Company by its new owners embody plans of exceptional interest to stockholders and investors. A total bond issue of $400,000 is authorized, but only $350,000 is being put out. The capital stock of the company will remain at $100,000.

A recent decision handed down by Judge Garman, of Luzerne county, practically awards to the borough of Forty Fort a tract of coal land valued at $100,000, which is being mined now by the Lehigh Valley Coal Company. The original deed dates back to 1768.

Pottsville—The Kaska William colliery, under the management of the Alliance Coal Company, will be extensively improved and developed. A contract has been awarded to a local firm covering several hundred yards of rock tunnel and this work will be started at once.

Washington

Ellensburg—Orders have been issued by the Northwestern Improvement Company that No. 6 mine, located in Roslyn, is to shut down on Nov. 1 for the winter. This is the largest mine at Roslyn. The order is the result of the company having sufficient coal on hand.

Seattle—A 5-ft. seam of coal was uncovered recently in Thompson Valley, B. C., south of Kamloops, by the grading crew of the Canadian Northern railway. The coal is said to be of commercial quality, and it is expected that the find will result in the immediate opening up of a new field.

West Virginia

Wheeling—W. G. Simpson, receiver for the Gorrell Coal Company, at Pipe Creek, has sold to J. W. Gorrell, the mine and equipment for $131,000. The mine, which contains 1000 acres of No. 8 Pittsburg coal, was appraised at $133,000. It is said Mr. Gorrell will organize a company and operate the mine.

The Consolidation Coal Company has secured the contract for 40,000 tons of steam coal for the Egyptian State Railways. This is the first time the latter company has asked for tenders for American coal.

Canada

Vancouver Island—The Western Fuel Company is opening two new mines. The Canadian Collieries, Ltd., has decided upon development and additions to plant, etc., involving an outlay of about $750,000. One important change will be the development of hydroelectric power as a substitute for the existing power plants at the several mines at Cumberland.

Alberta—Good progress is being made at the Chinook Coal Company's plant. The tipple is complete. The boiler house is under roof and machinery is being installed. Underground development also is being pushed rapidly forward.

PERSONALS

Samuel Stanley has resigned as sales manager of the Jackson-Superior Coal Company, Columbus, Ohio, and is succeeded by E. F. Aylward, of Cleveland.

E. N. Zern, mine superintendent with the H. C. Frick Coke Company and Jamison Coal and Coke Company since 1908, has been appointed assistant professor of coal mining in the University of Pittsburg.

C. B. Wadsworth, chief engineer for W. J. Rainey in the Connellsville coke region for the last 23 years, has resigned his position taking effect Nov. 1, after which he will take a rest at his home in Ravenna, Ohio.

Harry E. Zaring, formerly assistant secretary of the Crucible Steel Company of America, has been elected secretary of the Crucible Coal Company and will assist J. W. Neff, general manager, in the development of the company and its operations.

Harry S. Brady, who for the past two years has been general manager in Ohio for the Pittsburgh Plate Glass Company's coal interests, has left the latter company to become associated with the Cleveland office of the Moreland Coke Company, of Pittsburg.

COAL TRADE REVIEWS

Current Prices of Coal and Coke and Market Conditions in the Important Centers

General Review

The coal market, broadly speaking, still continues to show a little improvement as the season advances. While some sections report trade slow and prices sagging, in other districts the demand is urgent with offers of substantial premiums for spot deliveries.

In the extreme East, a genuine shortage of anthracite seems imminent, while bituminous is improving, although still weak in spots. The lake shipments continue unusually heavy, and demand is satisfactory.

Pittsburg reports mines still working 70 to 75 per cent. capacity with the market dull and heavy; however, the recent blowing-in of several furnaces may help the coke industry. The Ohio trade continues good with prices firm. A car shortage is developing on the Chesapeake & Ohio railroad, although it has not reached serious proportions. It is expected the Lakes will remain open till Dec. 1, and with the congestion relieved at the upper end, the shipments are now heavy.

The Middle West market continues dull. The effects of the Illinois Central strike are becoming apparent and it is thought if this trouble is not settled within the next two weeks, the situation will become serious.

Labor troubles and heavy snowfall, with a decided drop in temperature, are making demands in the West urgent. On the Pacific coast the market is normal and supplies adequate.

Boston, Mass.

Anthracite and advancing freights are the features here this week. Rates on hatch loads of bituminous in Reading barges are 75c. from Philadelphia to Boston, instead of 65c., and the supply of barges is so short for anthracite generally that soon we shall be facing a genuine scarcity in all sizes. It is said that during the week ending Oct. 21, not a single Reading tow arrived in Philadelphia, and with the brisk demand now, and the complications almost in sight, there is little prospect of the companies catching up on deliveries. Then, too, a number of buyers in the East are suddenly waking up to the nearness of winter and are crowding their usual sources of supply for immediate shipments. The eastern storage depots for some of the anthracite-producing companies are said to be practically bare of stock and anything like early replenishment is not yet in view. Anthracite within the week has taken a serious turn, serious for those caught with light supplies.

This week, the first of clear weather for some time, was one of heavy water arrivals, both in anthracite and bituminous, but the shortage in tonnage is now so marked, and the season is so far on, that there is likely to be no recession in rates, at least for the rest of 1911. Freights east from New York to the shoaler points about the Penobscot are now firm at $1, where a fortnight ago they were 65 to 75c.

All-rail in bituminous there is no apparent change. Sales agents and operators alike have had so discouraging a year that they are rather diffident over the immediate future. The Southern coals will have to move up considerably before there will be much extra tonnage for Pennsylvania.

Pocahontas and New River prices at Mystic wharf are up, although a rumored sale at $3.75 on the cars is rather discredited; $3.53, however, seems a firm figure, but it should be said that what coal is at the railroad piers is almost exclusively on contract. There is little free coal and there is not likely to be until transportation begins to move again with something like regularity. On an 85c. freight, $3.53 would still be a low price, netting but $2.45 f.o.b., Hampton Roads, or $1.05 at the mines, less commission, although, of course, such sales now are on bottoms chartered some weeks ago.

New York

A very satisfactory demand on contract for the higher-grade steam coals continues to be the feature of the coal business in the New York market. The supply of these grades at the New York piers is more than adequate to the demand, but with the contract movement so good, prices for standard grades while not strong, show no tendency to decline. Inferior steam coals are in oversupply in this market and as there has been considerable of it on demurrage, prices have been made in a number of instances, regardless of the cost of production, to escape further penalties.

The car supply at the mines furnishing this market continues to be satisfactory, but at some of those mines shipping to the West, a scarcity of equipment is beginning to be noticed.

Railroad movement to New York tidewater has been exceptionally good this fall, and that is one reason for the large standing tonnage now at the New York piers.

Prices for steam coals have not changed any this week, and with the exception of the demurrage coal, range about as follows: $2.35 f.o.b. for West Virginia steam coals; $2.55 for ordinary Pennsylvanias; $2.65, fair-grade Pennsylvanias; and $2.75@2.85 for the better grades.

The supply of slack coal seems to have been somewhat reduced, and there is a little more demand for this grade.

Pittsburg

Bituminous—While the lake movement is nearly over, a considerable tonnage will be moved in November. Mine operations have shown no material change thus far, and are between 70 and 75 per cent. of capacity. Prices are unchanged, the ones here quoted being under the nominal market, but subject to occasional further shading: Nut, $1@1.05; mine-run, $1.05@1.10; ¾-in., $1.15@1.20; 1¼-in., $1.25@1.30; slack, 40@50c. per ton at mine, Pittsburg district.

Connellsville Coke—The market continues in its rut. There is no interest in contracts for next year, and the small sales of prompt coke being made are at unchanged prices. Several lots of prompt furnace coke, aggregating perhaps 50 cars, have changed hands in the past week at $1.50, which has been the quotable market for several weeks. One sale for forward delivery is reported within the past week, a lot of 6000 or 7000 tons for November and December delivery, at $1.55, ovens, a fair price at this time of year when prompt coke is $1.50. The movement in foundry coke is light. We quote per net ton, f.o.b. ovens: Prompt furnace, $1.50; contracts over first half (nominal), $1.65@1.75; prompt foundry, $1.80@1.90; contract foundry, $2@2.25.

A second Wickwire furnace at Buffalo went into blast last week and Clinton, in Pittsburg, goes in blast this week, both stacks using tributary Connellsville coke.

The *Courier* reports production in the Connellsville and Lower Connellsville region in the week ending Oct. 21 at 310,766 tons, an increase of 500 tons, and shipments at 3791 cars to Pittsburg, 4933 cars to points west and 1039 cars to points east, a total of 9763 cars, an increase of 300 cars.

One of the two Zug Island blast furnaces of the Detroit Iron and Steel Com-

pany, at Detroit, Mich., has been regularly in blast, using Connellsville coke. The other stack, which regularly uses byproduct coke, has been out for several months, during which time it has been converted to a "thin-wall" furnace, the lining being made one brick thick and the steel shell being equipped with a water-cooling arrangement.

Philadelphia

There is not the feverish activity in the retail trade that was manifested earlier in the month, and the trade has now settled down to a good strong current of business. There is some difficulty in having orders promptly filled for some of the sizes, but, as a rule, the delays are not serious. Compared with last year, dealers report that their tonnage is considerably ahead, and it looks as though the prediction of a hard winter is beginning to bear fruit in the minds of the prudent householders.

The wholesale trade still continues active as earlier in the month. Careful inquiry shows that none of the sizes are lagging, many of the companies are behind on deliveries, and it has even come to picking up coal from stock, which is rather unusual at this season of the year. The tonnage is reported as showing a very comfortable increase over the preceding year, with no apparent signs of a falling off. The stormy weather prevailing along the coast during the last week has interfered materially with the movement of water coal, and as a consequence there is a large number of cars on hand at tidewater. This condition will, no doubt, change soon, as open weather has been predicted, which will enable vessels to land.

The improvement in the bituminous trade has been very marked during the past week, but the inclement weather has interfered with movement, and while the coal has been sold and is waiting shipment, it is causing the operators considerable anxiety and annoyance, with fear of large demurrage bills. But the fact remains that there is a general improved tone to this branch of the trade, and it looks to be permanent.

Buffalo, N. Y.

There is a steady, though slow, improvement in the soft-coal trade. Dealers and operators express doubt and dissatisfaction with conditions as they see no material change for the better and so are inclined to believe that the increased demand is a mere reflex of the time of the year, and they do not expect any advance in prices until the rush comes after the first of the year, when consumers become afraid that the supply will stop in April on account of labor disputes.

The volume of trade is as large as it was a year ago, so the complaint is all on account of low prices. It takes a very large tonnage to insure a fair profit, so the small jobber is accomplishing very little and as a rule the operators are complaining that they are only paying expenses.

Soft coal is unchanged in price, Pittsburg three-quarter is quoted at $2.50, mine-run at $2.40 and slack at $2, with Allegheny Valley prices from 20 to 30c. lower. There is no stir in coke at $4.25 for best Connellsville foundry, and $3.50 for stock coke. There is a good demand for smithing coal at $4 from Georges Creek, Cumberland. The supply of cannel coal is increasing, but there is demand enough to meet it, at $4.25. Retailers are making a price of $7 for cannel, which they usually sell in small quantities.

The hard-coal movement is large, even for the time of the year, especially by lake. Early in the season it was thought that the record-breaking movement would give way long before this, as the upper lake docks would be full to capacity, but it is now reported that the glut of soft coal is much greater than the hard. Lake shipments of anthracite from this port continue at about 100,000 tons a week.

Cleveland, Ohio

The Lake coal business for this season is practically closed. A large tonnage on cars still remains on track, both at Cleveland and along the Lake Erie points, awaiting boats for loading. This is to be held over at this end and the upper Lake points during the winter.

It is understood that all contracts have been canceled for any further shipments north this season, and the consequence is that the shippers are paying car service on the coal that is now on track, if not reconsigned prior to Dec. 1, which is the time limit given by the railroads. The result is that shippers are using every effort in procuring boats and loading same as fast as the machines can unload the cars.

The domestic trade has taken another spurt in the past week, here as well as in rural districts in Ohio. The approaching cold weather and the expected scarcity of cars, is the natural consequence in this case. It is also noticeable that the steam trade has somewhat improved. Prices, however, in both the domestic and steam trade, have not shown any appreciable advance up to the present time. Dealers are looking forward in the near future for the better prices, which naturally follow when demand increases.

Columbus, Ohio

More favorable weather, in the form of a slight cold snap, caused an increased demand for domestic grades and as a result the entire trade showed a better feeling. Orders for immediate shipment for domestic uses came in fast and the tonnage moved during the past week was much larger than the week previous. Prices are being well maintained at the quotations in the circular of Sept. 1, although there are some complaints of price cutting.

Steam business is running along unchanged. There is a feeling of uncertainty in the manufacturing establishments and they are not taking supplies for the future. The policy followed is to buy only what is needed for immediate wants. Railroads are also using a minimum as the freight movement is still small.

One of the best features of the market is the lake trade, which has regained its activity, and the tonnage is increasing from all Ohio fields that participate in the lake traffic.

The congestion of the docks of the upper lake ports is passing away and the movement to the interior is better. There is nothing at the present time to interfere with an active lake trade right up to the close of navigation, which is expected to be about Dec. 1.

The following are the prevailing prices, per ton in the Ohio field:

Fancy domestic	$1.75@$2.25
Domestic lump	1.50@ 1.65
¾-in.	1.35
Nut	1.15
Mine-run	0.95@ 1.15
Pea and slack	0.40@ 0.50
Coarse slack	0.35@ 0.40

Cincinnati, Ohio

The tone of the local market is optimistic. Steam business is holding its own—if not slightly improved—and domestic trade is considerably better. Probably hundreds of furnaces in homes and steam plants in large buildings were equipped for gas consumption during the past summer and the retailers have begun to receive notice of it when they make inquiries as to why the usual order for the winter's supply of coal had not been received. The wholesalers feel it, indirectly, of course, but they are not so vitally affected because coal that cannot be sold in this immediate market is offered in some other market, while the retailer's market is very restricted.

Steam prices are unchanged, as also are the domestic. The car shortage on the Chesapeake & Ohio railroad continues and several operations report that they have had to shut down one or more days the past week in consequence. Cars are constantly being released from the lake trade, but the effect of that is of doubtful value as they are then used for long-distance hauls and are more difficult to keep track of than in the short haul to and from the lakes. Should bad weather add to the situation it is more than likely that the car shortage would assume a serious aspect.

The retail prices for fuel delivered are unchanged and continue as follows: Smokeless lump, $4@4.25; smokeless mine-run, $2.60@2.75; bituminous lump, $3@3.25; bituminous nut and slack, $1.90@2; anthracite, $7.25, since Sept. 1, when the price was advanced 25 cents.

Charleston, W. Va.

While there is an appearance of greater firmness and possibly a little more activity, there is no enthusiasm over conditions in the coal trade, especially as applied to the Kanawha and New River territories. It is opinion of some of the best judges of conditions and of the future that coal-trade conditions will not be very good until after 1912 has gone into history.

There are, however, a number of instances where mines are doing a big business and are running up to capacity, and what is more encouraging, are making preparations for greater outputs to meet the demands for their particular coal.

Indianapolis, Ind.

The brightest spot in the Indiana market appears to be in the Vigo field in the vicinity of West Terre Haute. John Nathway, sales agent for the Hall Zimmerman Mining Company, says that conditions are not nearly so bad as painted. "The summer has been unusually good with us and our mines have lost hardly a day throughout the season," said he.

On the other hand, operators in other fields say that during the past history of the coal-mining business in Indiana, October and November have been the biggest coal-selling months. Previous to this, during these months dealers have bought coal at the mines to fill their current demands against the winter needs. The operators say the dealers are taking less precaution to supply themselves this year in advance of cold weather. It is apparent, the operators say, that both retailers and consumers have decided to depend largely upon the open market.

Coal prices are demoralizing. With short demand for steam coal, operators have been trying to push domestic coal on the market and this has depressed prices still further. The domestic supply in market centers is said to be unusually low, considering the season, and a week or ten days of severe weather would exhaust the supply.

Minneapolis—St. Paul

There is a decidedly improved condition to be noted in the coal trade of the Twin cities. Retail orders have been coming in at a good rate, not in a rush, as is the case when a severe cold snap occurs, but rather a steady flow which the retailer has been able to keep up with. This is well, for the roads are in very poor condition for heavy hauling.

These two growing centers of population are evidently looked upon as natural outlets for dock coal, being but 150 miles from the head of the Lakes where an immense tonnage of both anthracite and bituminous coal is held in storage for distribution. It is estimated Minneapolis uses, in round numbers, 900,000 tons yearly, about 200,000 anthracite and 700,000 tons of bituminous. St. Paul uses about three-fourths of this amount to supply its fuel needs, and there is a healthy increase in tonnage yearly.

St. Louis, Mo.

Illinois Central mines are working about two days a week, and reliable reports state that approximately 400 cars per day, of Illinois Central equipment, are being pushed on side tracks in bad order. There is no improvement in strike conditions on that road, despite the statements of the company, and it is the general opinion that, unless the strike is settled in a few weeks, more than two-thirds of its coal equipment will be tied up.

There is some car shortage on the Iron Mountain and a lack of motive power on the Chicago & Eastern Illinois. Other roads are taking care of the business offered.

The prevailing prices per ton are as follows:

Franklin County:	
6-inch lump	$1.65@$1.75
3x6 egg	1.60@ 1.70
No. 1 nut	1.50@ 1.60
No. 2 nut	1.35@ 1.40
Carterville:	
6-inch lump	$1.50@$1.60
3x6 egg	1.45@ 1.55
No. 1 nut	1.20@ 1.30
No. 2 nut	1.00@ 1.10
Mine run	1.05
Screenings	0.55
Big Muddy domestic lump	$2.10

All the above taking a 67c. freight rate to St. Louis.

Standard:	
6-inch lump	$1.10@$1.15
2-inch lump	0.95@ 1.00
Screenings	0.30@ 0.35

Gas-house and byproduct coke is moving freely, and smokeless is somewhat hard to get.

Colorado

The first snow storm of the year has just been experienced in this vicinity and while the snow was not general, a decided drop in temperature is reported from all districts, creating an increased demand for domestic coal for prompt shipment. Mines are not being forced to full capacity, but are enjoying a better business than has been evidenced for some time. Winter prices are now in effect at 25c. per ton more on all grades than the ruling prices of a year ago.

Effective Oct. 23, Northern Colorado lignite advanced 25c. per ton on the Denver market, and the better grades are now selling at $2.80 per ton f.o.b. mine. The retailers have increased their prices correspondingly and are asking $5.25 per ton, which is 75c. per ton higher than prices in effect a year ago, and 25c. per ton more than has been asked for several years past. A large percentage of the domestic coal used in Denver is of this grade and the Denver market practically consumes the output of these mines. Labor trouble reflecting increased costs and uncertain supply, is responsible for the advance.

Salt Lake City, Utah

Idaho dealers are beginning to realize that one mild winter with plenty of coal for everybody does not assure them a continuance of that condition for the following year.

Telephone and telegraph are kept busy these days with messages from the towns in that State, begging for coal of some description. Many dealers have paid visits to Salt Lake to make their appeals personally. With Utah dealers still unsatisfied, the prospects for any great amount of coal being shipped to surrounding States from Utah mines is not very great.

A large Nevada consumer this week offered $3, f.o.b. mine, for 1000 tons. Retail trade is not strong, but as good as retailers can look for under mine conditions. There are rumors of an advance in the mine price, but nothing has been announced as yet.

Portland, Ore.

The coal trade here is not unusually brisk at this time because of the fair weather. The Diamond Crest Coal Company, 325 Railway Exchange building, is placing on the local market a coal from its mines at Tenino, Wash., for $6.50 per ton in order to get it introduced to the consumer. It is said that the coal is a high-grade lignite and the company operates three mines.

Following are the prices asked here, per ton, including cost of delivery to points within the city proper:

Japanese	$7.50	
Washington lignite	$7.00@ 7.50	
Australian	10.00@10.50	
Rock Springs, Wyo.	10.00@10.50	nut $9.50
Diamond, Wyo.	10.00	
Carbon Hill, Wash., lump	10.50	
Carbon Hill, steam	7.50	
Newcastle, Wash.	7.00	
Beaver Hill, Ore.	9.00@ 9.25	
Blacksmith coal	17.00	

San Francisco

The arrivals for the week by water are very light, consisting of but two small shipments, one from British Columbia of 1506 tons, and the second from Washington of 1000 tons, making a total of 2506 tons.

There is ample coal in stock to supply all immediate demands. Retail dealers continue storing for their winter needs.

Prices for the week remain unchanged, and are as follows, per short ton:

Wellington—clean	$8.00
Wellington—average	7.50
Australian—clean	8.00
Australian—average	7.50
Seattle—clean	6.50
Seattle—steam	5.00
Utah, Wyoming and New Mexico—clean (for domestic use only)	8.15
Pennsylvania anthracite	15.00
Welsh anthracite	13.50
Colorado and New Mexico anthracite	12.50
Cumberland—smithing	12.50